UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

November 4, 2003

Magalie Roman Salas, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

RE: Draft Biological Opinion For ESA Section 7 Consultation for White River Hydroelectric Project (FERC No. 2494-002). NOAA Fisheries Consultation No. F/NWR/1999/01862.

Dear Ms. Salas:

Enclosed please find a draft Endangered Species Act (ESA) Section 7 biological opinion and Magnuson-Stevens Fishery Conservation and Management Act consultation regarding the Federal Energy Regulatory Commission's (FERC) proposal to issue an operating license to Puget Sound Energy (PSE) for operation of the White River Hydroelectric Project (FERC No. 2494-002). This draft represents the National Marine Fisheries Service's (NOAA Fisheries) response to your July 16, 1999, biological assessment.

Please note that the Lake Tapps regional water supply project tentatively proposed by PSE to the Washington Department of Ecology is not analyzed in this draft opinion and will not be analyzed in the final biological opinion. This action is not proposed in FERC's biological assessment, but it depends on the features of the White River Hydroelectric Project - diversion dam, flume, and Lake Tapps - and will require subsequent ESA Section 7(a)(2) consultation.

Also, the draft includes placeholder language for Reasonable and Prudent Alternative 12 relating to artificial production, which we intend to modify pursuant to further discussion of this item between the parties that is expected to occur prior to issuance of the final Biological Opinion.

We request your review of this draft Biological Opinion by December 5, 2003 (approximately 30 days from receipt). We are available to meet with FERC staff, PSE, and the U.S. Army Corps of Engineers to explain and discuss our findings and the reasonable and prudent alternative during this period. In addition, we intend to meet with other interested parties, including the members of the Lake Tapps Task Force, upon request. If you have any questions or concerns about this consultation or the consultation process in general, please feel free to contact Steve Fransen at 360-753-6038, or e-mail Steve.Fransen@noaa.gov.

Sincerely,

Brian J. Brown

for D. Robert Lohn
Regional Administrator

Enclosure

cc: Original and 8 Copies to the Secretary
FERC Service List

Endangered Species Act
Section 7 Consultation

Draft

Biological Opinion

and

Magnuson-Stevens Fishery Conservation and Management Act Consultation

White River Hydroelectric Project

FERC Project Number 2494-002

Action Agency:	Federal Energy Regulatory Commission
Consultation Conducted by:	NOAA Fisheries Northwest Region Hydropower Division
NMFS Log Number:	F/NWR/1999/01862
Date:	October 31, 2003

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1. INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 USC 1531-1544), as amended, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NOAA Fisheries), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species. This biological opinion (Opinion) is the product of an interagency consultation pursuant to Section 7(a)(2) of the ESA and implementing regulations found at 50 CFR 402. The analysis also fulfills requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The administrative record for this consultation is on file with the Hydropower Division, NOAA Fisheries, Northwest Region.

The Federal Energy Regulatory Commission (FERC) proposes to issue an operating licence to Puget Sound Energy, Inc. (PSE), a private power generation and distribution corporation, for the operation of the White River Hydroelectric Project, located near Buckley, Washington. The purpose of this project is to generate and sell electricity. FERC is proposing to issue the license according to its authority under the Federal Power Act (FPA).

1.1 Background and Consultation History

The White River project was constructed over the period of 1910-1912 and was operated as an unlicensed hydroelectric project until 1981 (though an application for license was filed in 1964 and withdrawn in 1972). In that year, the U.S. Court of Appeals for the Ninth Circuit decided that the White River, at the project site, is navigable as defined by the FPA. Therefore, operation of the project requires a license. On November 23, 1983, Puget Sound Power and Light (now known as Puget Sound Energy) filed an application with FERC for a major project at an existing dam. On December 19, 1997, FERC issued an original license order for the project. NOAA Fisheries, jointly with the USFWS, Washington Department of Fisheries, Washington Department of Ecology (WDOE), and PSE filed rehearing requests.

On December 7, 1998, FERC staff conferred with NOAA Fisheries and other interested parties regarding the possibility that the licensing of the White River project could jeopardize the continued existence of the Puget Sound evolutionarily significant unit (ESU) of chinook salmon. NOAA Fisheries recommended that FERC delay action on the pending rehearing request to allow time for ESA consultation and time to determine if its existing Section 10(j) of the FPA recommendations were technically sound for protection of a listed species. PSE asked FERC for 18 to 24 months to negotiate a settlement with the parties, and NOAA Fisheries indicated that it would complete the ESA Section 7 analysis before the end of that period. FERC issued a two-year stay of the license in 1999 that specified minimum flows to the bypassed reach of no less than 130 cfs and put restrictions on ramping rates and the timing of scheduled outages. Current minimum flows in the bypassed reach were set by an agreement between PSE and the resource agencies (NOAA Fisheries, Washington Department of Fish and Wildlife [WDFW], and USFWS), effective July 2001.

On March 24, 1999, NOAA Fisheries published a Federal Register notice final rule listing the Puget Sound ESU of chinook salmon (*Oncorhynchus tshawytscha*) (PS chinook salmon) as a threatened species under the ESA. White River spring and summer/fall run chinook salmon are included in the PS chinook salmon ESU (64 FR 14308).

NOAA Fisheries received a biological assessment (BA) completed by FERC and a request to initiate formal consultation under Section 7(a)(2) of the ESA on July 16, 1999. Limited resources and a large backlog of requests for biological opinions delayed NOAA Fisheries' action on this biological opinion until early 2002. On February 22, 2002, NOAA Fisheries notified FERC that the BA was complete and that consultation was initiated at that time. NOAA Fisheries met with FERC and PSE on June 20, 2002, and subsequently with PSE and the Lake Tapps Task Force (LTTF) on July 16, 2002, and then again with PSE on July 22, August 12, and September 4, 2002.

On October 8, 2002, NOAA Fisheries provided a preliminary draft biological opinion to FERC and PSE. Although no additional formal consultation meetings have occurred with FERC, NOAA Fisheries received comments on the October 8th draft opinion from numerous parties. Commenters included the U.S. Army Corps of Engineers (Corps), Seattle District; the Environmental Protection Agency, Region 10 (EPA); WDFW; the Puyallup Tribe of Indians; the Muckleshoot Indian Tribe; USFWS; and the combined comments of PSE, Pierce County, and the LTTF. A series of technical meetings regarding the draft opinion was held at PSE's and the LTTF's request with them and other interested parties, generally excluding the tribes. The meetings covered issues relevant to the tribes, such as water quality, salmon populations, and fish harvests, as well as instream flows that the MIT previously settled with PSE in a separate agreement. However, tribal representatives informed NOAA Fisheries that PSE requested they not attend. The meetings were held October 16, 21, November 1, 4, 7, 2002.

New scientific information included in the comments was incorporated into relevant sections of this Biological Opinion. Where comments raised issues of alternative data sources or alternative interpretations of scientific analyses, NOAA Fisheries included in the relevant sections of this Biological Opinion a description of the range of scientific opinion and our rationale for determining either that the full range or some portion of that range represented the best available scientific information. Relevant comments that addressed whether proposed reasonable and prudent alternative (RPA) elements were, in fact, reasonable and prudent are discussed in the description of the RPA. A summary of comments and NOAA Fisheries' response to each is included in Appendix A.

This opinion responds to comments received and revises the RPA to avoid jeopardy. On July 16, 2003, NOAA Fisheries issued this second draft biological opinion to FERC and PSE.

The Federal Trust Responsibility

Under the Federal trust responsibility, Federal agencies, including NOAA Fisheries, have a legal obligation to support the Puget Sound tribes in their efforts to preserve and rebuild treaty salmon fisheries in their usual and accustomed areas. The concept of "trust responsibility" is derived from the special relationship between the Federal government and Indians, first delineated by Supreme Court Chief Justice John Marshall in *Cherokee Nation* v. *Georgia*, 30 U.S. 1(5 Pet.) (1831). Later, in *Seminole Nation* v. *United States*, 316 U.S. 286 (1942), the Supreme Court noted that the United States "has charged itself with moral obligations of the highest responsibility and trust" towards Indian tribes. The scope of the Federal trust relationship is broad and incumbent upon all Federal agencies. The U.S. Government has an obligation to protect tribal land, assets, and resources, as well as a duty to carry out the mandates of Federal law with respect to American Indian and Alaska Native tribes. This special relationship provides the Constitutional basis for legislation, treaties, and Executive Orders (EO) that grant unique rights or privileges to Native Americans to protect their property and way of life.

In furtherance of this trust responsibility, and to demonstrate respect for sovereign tribal governments, the principles described above were incorporated into Secretarial Order No. 3206, dated June 5, 1997, and signed by the U.S. Secretary of Commerce and the U.S. Secretary of Interior. This order, the American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act, directs the Department of Commerce and the Department of Interior to carry out their respective responsibilities under the ESA in a manner that harmonizes the Federal trust responsibility with tribes, tribal sovereignty, and statutory missions of each department, so as to avoid or minimize the potential for conflict and confrontation.

On May 14, 1998, EO 13084, Consultation and Coordination with Indian Tribal Governments, was issued, requiring each Federal agency to establish meaningful consultation and collaboration with Indian tribal governments in formulating policies that significantly or uniquely affect their communities. The order requires Federal agency policy-making to be guided by principles of respect for tribal treaty rights and responsibilities that arise from the unique legal relationship between the Federal Government and Indian tribal governments. Furthermore, on issues relating to treaty rights, EO 13084 directs each agency to explore and, where appropriate, use consensual mechanisms for developing regulations.

On November 6, 2000, EO 13175 was signed, which supercedes EO 13084. The order carries the same title, but strengthens the government-to-government relationship between the United States and Indian tribes. It ensures that all Federal Executive departments and agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Native American communities.

Because this ESA consultation is likely to affect Indian lands, tribal trust resources, and the exercise of American Indian tribal rights, NOAA Fisheries notified the Muckleshoot and Puyallup tribes of the consultation regarding the White River project. In March and April of 2002, NOAA Fisheries participated in technical and government-to-government level consultations with the Muckleshoot and Puyallup tribes. These actions were taken in accordance with Secretarial Order 3206 (June 5, 1997), which provides instructions for notification and consultation with American Indian tribes when tribal interests may be affected by NOAA Fisheries ESA consultations.

1.2 Proposed Action

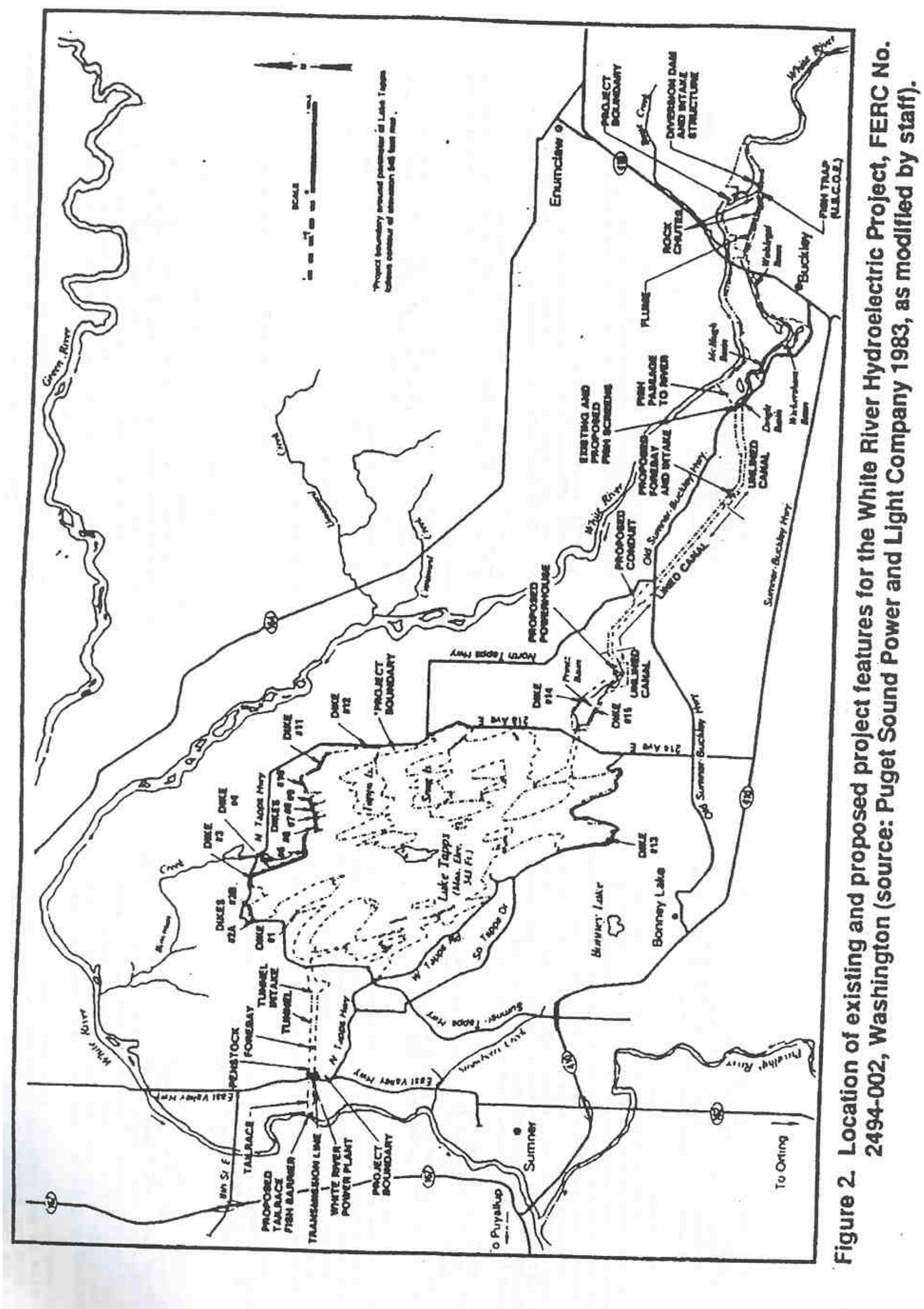
Proposed actions are defined in NOAA Fisheries' regulations (50 CFR 402.02) as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The proposed action entails the issuance of an original license by FERC for a major project at an existing dam, with continued operation, maintenance and proposed modifications to the White River Hydroelectric Project as described in the FERC Order issuing original license project No. 2494-002, December 19, 1997. Because FERC proposes to issue a license, it must consult under ESA Section 7(a)(2). The standards for determining jeopardy and destruction or adverse modification of critical habitat are set forth in Section 7(a)(2) of the ESA as defined by 50 CFR Part 402 (the consultation regulations).

1.2.1 General Description of the Project

The operation of this project is made possible by the particular geography of the land near Buckley, Washington (Figure 1-1). A plateau extends due east from Buckley and at the base of the plateau is the Stuck Valley. The White River flows west past Buckley and enters the valley. Water is diverted from the river upstream of the valley (river mile [RM] 24.3) and conveyed via a canal (flowline) to Lake Tapps, which is located on top of the plateau. The 484-foot elevation difference between Lake Tapps and the Stuck Valley floor is used to generate electricity by sending water through steel penstocks to a powerhouse located on the valley floor. The water is then returned to the river by a tailrace channel at (RM 3.5).

The White River project was built between 1910 and 1912. The diversion dam is located near the city of Buckley (RM 23.5). The dam is a 352-foot-long, 11-foot-high, timber crib dam with a concrete intake structure. There is also an upstream migrant fish trap located on the dam. The trap is operated by the Corps to facilitate fish passage upstream of the White River project and the next dam upstream, Mud Mountain Dam (MMD), which is also operated by the Corps. There are no fish passage facilities on the dam other than the trap.

Figure 1-1. Diagram of White River Hydroelectric Project (source: White River Biological Assessment, figure 2).



The flow of water from the intake structure into the flowline is controlled by two vertical gates (controlled by an antiquated motor and reduction gear system). The flowline, with a hydraulic capacity of 2000 cubic feet per second (cfs), is comprised of wooden flumes, five settling basins, a concrete canal, an unlined canal, and large diameter concrete pipe that conveys the diverted water to the 27,000 acre storage reservoir, Lake Tapps. Fish are removed from the intake by a fish screen and returned to the river via a bypass conduit (built in 1996 to replace a facility built in 1939). The screen facility is located downstream of settling basins. Downstream of the fish screen the water travels through concrete pipe and empties into an earthen canal which enters Lake Tapps.

Lake Tapps was created in 1910-1911 by the construction of dikes and excavations to connect several small natural lakes. It has an irregular shoreline and numerous small islands. The islands and nearly four-fifths of the lake shoreline have undergone residential development. Lake Tapps has 46,700 acre-feet of usable storage at the normal maximum surface elevation of 543 feet above mean sea level. Releases from Lake Tapps are regulated to meet daily power demand fluctuations.

Water from Lake Tapps is collected at the powerhouse forebay. The water enters the forebay well and is delivered to three 2,135-foot-long steel penstocks; two penstocks supply a fourth 1791-foot-long penstock. The powerhouse is equipped with four turbine generator units with a total installed capacity of 70 megawatts. Water leaves the powerhouse and returns to the White River channel at RM 3.5 by means of a 0.5-mile, 34-foot-wide tailrace channel. The project creates an approximately 21-mile-long bypassed reach of the White River between the dam and powerhouse tailrace.

1.2.2 Proposed License

FERC's proposed action is detailed in license articles contained in the license order. Certain license articles are either unclear or lack sufficient detail necessary to assess the specific action. In developing this Opinion, RPAs, and incidental take statement, NOAA Fisheries does not assume implementation of any measure not explicitly required in the license. Below, we review the license articles relevant to the survival and recovery of PS chinook salmon.

<u>Article 302</u>: This article requires cofferdams to be consistent with FERC-approved designs and erosion control plans and measures for new construction and modification of existing structures.

In the license application, PSE proposes to replace the wooden flashboard system on the diversion dam with a concrete structure with sluice gates to reduce the amount of sediment entering the flowline. This would require a major renovation or complete reconstruction of the diversion dam. License articles 302 and 401 require cofferdams to be consistent with approved designs and erosion control plans and measures for new construction and modification of existing structures. However, neither these or other license articles specifies that the project diversion dam will actually be renovated or reconstructed. Therefore, NOAA Fisheries does not consider reconstruction of the diversion dam to be a component of the proposed action.

Article 402: This article requires implementation of the Sediment Disposal Plan file with FERC on June 28, 1990, which describes on-site disposal. The Licensee is required to file another plan for any off-site disposal. FERC reserves the right to require changes to the off-site sediment disposal plan. Such a plan shall be developed in consultation with NOAA Fisheries and other resource agencies. This article leaves open the possibility of disposing of excess sediment by returning it to the bypass reach of the river.

Article 403: This article authorizes the PSE White River project to continue operations under ramping rate restrictions described in Table 1-1.

Table 1-1. Proposed interim ramping rates (rate of change in water surface elevation) as per FERC license article 403 to be implemented after the installation of stream gages to monitor flows.

Season	Daylight rates*	Night rates
February 16 to June 15	No Ramping	2 inches/hour
June 16 to October 31	1 inch/hour	1 inch/hour
November 1 to February 15	2 inches/hour	2 inches/hour

* Daylight is defined as 1 hour before sunrise to 1 hour after sunset

Within 60 days after the approval of the monitoring plan, PSE would be required to adhere to specified ramping rates. The project would be operated under this ramping rate schedule until FERC approves an alternative schedule. The license requires PSE to submit a site specific study plan to establish maximum change in river flow (ramping rates) and the flows under which the ramping rate restrictions would apply within six months of license issuance. PSE is required to consult with the Muckleshoot and Puyallup tribes, NOAA Fisheries, WDFW, and USFWS before submitting the ramping rate plan. The new ramping rate plan would be implemented upon FERC approval.

Article 404: This article requires the Licensee to file a study plan for FERC approval to establish limits on maximum downramping rates and identify the critical flow at which downramping restrictions would begin.

Article 405: This article sets minimum instantaneous flow rates at the diversion dam to the bypassed reach, as described in Table 1-2.

Table 1-2. Minimum consistent flows to be maintained in the bypassed reach as per FERC license article 405.

Season	**Minimum consistent flow in bypassed reach in cubic feet per second (CFS)**
February-July	180
August - September	350
October	400
November-December	265

Within 60 days after the approval of the monitoring plan prescribe in article 406, PSE would be required to maintain specified levels of flow in the bypassed reach.

Article 406: Monitoring of proposed ramping and minimum bypassed reach flows would be accomplished by stream gages installed and monitored by PSE. This article requires PSE to submit a plan to install and monitor stream gages to monitor ramping rates and minimum flows in the bypassed reach within six months of license issuance.

Article 407: This article requires implementation of the Lake Tapps Fisheries Enhancement Plan (June 28, 1990) which includes requirements to:

a. Provide funding to WDFW to stock 450,000 kokanee fry at about 1,000 fish per pound.
b. Conduct a zooplankton survey in the lake to coordinate the stocking with spring blooms.
c. Provide funding to WDFW to rear and stock 50,00 fingerling rainbow trout (stocked at 50 fish/lb) annually.
d. Conduct an annual creel census for at least the first five years of the program to monitor the success of these efforts.
e. Install 1,500 lineal feet of artificial habitat units at locations chosen by WDFW.
f. Monitor the success of these habitat units and determine the need for expanding the artificial habitat or further tests.

Article 408: This article requires construction of a barrier where the tailrace of the existing power plant joins the White River. The purpose of the barrier is to prevent migrating salmonids from traveling up the powerhouse tailrace channel. Flows in the tailrace usually exceed those in the river channel upstream of the tailrace. Thus, tailrace flows attract upstream migrating salmonids that typically orient to the strongest flow when seeking upstream passage routes. The license requires PSE to submit designs of the tailrace barrier to FERC for approval, after consulting with the Muckleshoot and Puyallup tribes, WDFW, USFWS, and NOAA Fisheries, within six months of the date the license is issued.

Article 409: This article requires the Licensee to file an Evaluation, Operation, and Maintenance Plan for the tailrace barrier and fish passage facilities required in article 408.

Article 412: This article requires the Licensee to file a plan to revegetate disturbed areas associated with construction of the fish screen and pipeline.

Article 419: This article allows the Licensee to grant certain types of use and occupancy of project lands and waters without prior FERC approval. This includes limited water diversion and use of up to approximately 1 million gallons per day.

1.2.3 Duration of Proposed Action and Term of this Biological Opinion

The term of the proposed license is 50 years. The term of this Opinion is for the term of the license. However, as noted in section 2.1.5, consultation must be reinitiated if the amount or extent of taking specified in the incidental take statement is exceeded, or is expected to be exceeded; if new information reveals effects of the action may affect listed species in a way not previously considered; if the action is modified in a way that causes an effect on listed species that was not previously considered; or if a new species is listed or critical habitat is designated that may be affected by the action (50 CFR §402.16).

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

The objective of this Opinion is to determine whether FERC's issuance of a license to PSE for operation of the White River Hydroelectric Project is likely to jeopardize the continued existence of PS chinook salmon. As explained below in section 2.1.1, NOAA Fisheries evaluates the impact of the project on habitat in its jeopardy analysis.

This Opinion does not include a critical habitat analysis, because critical habitat designations for this ESU were recently vacated by court order. On February 16, 2000, NOAA Fisheries designated critical habitat for 19 ESUs of chinook, chum, and sockeye salmon as well as steelhead trout in Washington, Oregon, Idaho, and California. On September 27, 2000, NOAA Fisheries approved Amendment 14 to the Pacific Coast Salmon Fishery Management Plan designating marine and freshwater essential fish habitat for Pacific salmon pursuant to the MSA. Shortly after these designations, the National Association of Homebuilders filed a lawsuit challenging the designations on a number of grounds. On April 30, 2002, the U.S. District Court for the District of Columbia adopted a consent decree resolving the claims in the lawsuit. Pursuant to that consent decree, the court issued an order vacating the critical habitat designations but retaining the MSA-essential fish habitat designations (National Association of Homebuilders et al. v. Evans, Civil Action No. 00-2799 [CKK] [D.D.C., April 30, 2002]). Thus, the critical habitat designation for PS chinook salmon is no longer in effect. NOAA Fisheries intends to reissue critical habitat designations. Reinitiation of consultation will be required if the proposed action affects critical habitat designated after consultation has been completed (50 CFR §402.16(d)).

2.1.1 Evaluating the Proposed Action

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 CFR 402.02 (the consultation regulations). In conducting analyses of habitat-altering actions under Section 7 of the ESA, NOAA Fisheries uses the following steps of the consultation regulations combined with the Habitat Approach (NMFS 1999b): 1) Consider the status and biological requirements of the species; 2) evaluate the relevance of the environmental baseline in the action area to the species' current status; 3) determine the effects of the proposed or continuing action on the species, and whether the action is consistent with the available recovery strategy; 4) consider cumulative effects; and 5) determine whether the proposed action, in light of the above factors, is likely to jeopardize the continued existence of species survival in the wild. In completing this step of the analysis, NOAA Fisheries determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species. If jeopardy is found, NOAA Fisheries will identify RPAs for the action that avoid jeopardy.

Recovery planning will help identify measures to help conserve listed salmonids and increase their survival at each life stage. NOAA Fisheries' recovery planning will identify the areas and stocks most critical to species survival and recovery, and we'll then evaluate proposed actions on the basis of their effects on those factors.

2.1.1.1 Description of the Action Area

An action area is defined by NOAA Fisheries regulations (50 CFR Part 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area affected by the proposed action ranges from the upstream limit of PS chinook salmon spawning to the Puyallup River estuary in Commencement Bay.

Project effects extend upstream to the limits of PS chinook salmon distribution because the project affects the numbers, condition, and timing of fish reaching the spawning grounds. The diversion dam poses an impassible barrier to upstream migrants, requiring that fish be trapped and handled before passing further upstream. Water diversion to Lake Tapps reduces flows in the bypassed reach that is part of the migration corridor, potentially affecting the number and timing of bypass reach spawners and adults moving upstream to the trap. This in turn affects the nutrient input to upstream ecosystems from salmon carcasses and the number of juvenile PS chinook salmon produced and reared in those upstream reaches.

Project effects extend downstream to the Puyallup River estuary because the diversion dam and bypass affect the volume and timing of sediment and nutrient transport to the estuary. Daily and seasonal variation in the amount of water returned to the White River channel may also affect the lower Puyallup and estuary. Migrating salmon enter the lower White River to encounter variable flow regimes that result from both natural hydrology and daily and hourly variations in energy generation. Nutrients carried by the river are critical to estuary function and transported sediments are critical to the formation and component structure of wetlands and other estuarine habitat types.

2.1.1.2 Biological Requirements

The first step NOAA Fisheries uses when applying the ESA Section 7(a)(2) to the listed ESUs considered in this Opinion is to define the species' biological requirements. Biological requirements within the action area are a subset of the range-wide biological requirements of the ESU. Identification of the range-wide biological requirements provides context for subsequent evaluation of action area biological requirements.

Relevant biological requirements are those necessary for the listed ESUs to survive and recover to naturally reproducing population sizes at which protection under the ESA would become unnecessary. This will occur when populations are large enough to safeguard the genetic diversity of the listed ESUs, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. McElhaney et al. (2000) describe the biological requirements of salmonid populations, which are the components of ESUs, as adequate abundance, productivity (population growth rate), spatial scale, and diversity. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle.

The Puget Sound Technical Recovery Team (PSTRT) has not yet identified a target abundance level for White River chinook salmon (WR chinook salmon) or other numerical population viability requirements for this population (PSTRT 2002).

For the ESU to survive and recover, adequate habitat and life-stage specific survival rates must occur within the action area. As described in NMFS (1999, "Habitat Approach"), there is a strong causal link between habitat modification and the response of salmonid populations. Those links are often difficult to quantify. In many cases, NOAA Fisheries must describe biological requirements in terms of habitat conditions in order to infer the populations' response to the effects of the action. To survive and recover, a wide-ranging salmonid ESU must have adequate habitat available for each life history stage.

For this consultation, the relevant biological requirements are important habitat elements that function to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and growth and development to the smolt stage. These important habitat elements for PS chinook salmon are: 1) substrate, 2) water quality, 3) water quantity, 4) water temperature, 5) water velocity, 6) cover/shelter, 7) food (juvenile only), 8) riparian vegetation, 9) space, and 10) safe passage conditions. The project activities are likely to affect each of these habitat elements. The majority of these important habitat elements are included in an analysis framework called *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (hereafter referred to as the "matrix") for making effects determinations at the watershed scale (NMFS 1996). NOAA Fisheries uses the matrix to evaluate the environmental baseline condition, and effects of the action on important habitat elements for affected PS chinook salmon.

2.1.1.3 Status of the Species

NOAA Fisheries considers the current status of the listed species, taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species within the action area, NOAA Fisheries starts with the determinations made in its decision to list for ESA protection the ESU considered in this Opinion and also considers any new data that is relevant to the determination. This section covers listing status, general life history, and population dynamics of species.

All five species of eastern Pacific salmon (chinook, coho, chum, pink, and sockeye) are found in the action area of the proposed project. Issuance of the White River project license may affect the threatened PS chinook salmon ESU. Based on life history timing for this ESU, it is likely that incubating egg, juvenile, smolt, and adult life stages of this listed species would be affected by the proposed action. Puget Sound coho salmon have been identified as a candidate species. Table 2-1 includes details regarding ESA determinations for these species.

Table 2-1. References for additional background on listing status and protective regulations for the ESA-listed and candidate species considered in this consultation.

Species ESU	Status	Protective Regulations
Chinook salmon (*O. tshawytscha*)		
Puget Sound (WA only)	Threatened; March 24, 1999; 64 FR 14308	July 10, 2000; 65 FR 42422
Coho salmon (*Oncorhynchus kisutch*)		
Puget Sound / Straight of Georgia (WA only)	Candidate; July 25, 1995; 60 FR 38011	Not applicable

The following is a brief summary of their status, life history, and population dynamics.

The PS chinook salmon ESU encompasses all naturally spawned runs of chinook salmon that occur downstream of impassible natural barriers in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula (Myers et al. 1998). Several hatchery stocks considered essential for recovery of the natural stocks are also included in the ESU (Table 1 of 64 FR 14308), including the White River hatchery stock. The PSTRT has tentatively identified 21 independent populations within the PS chinook salmon ESU (PSTRT 2001). Natural spawning escapement between 1992-96 averaged 13,000 for the north Puget Sound populations and long- and short-term trends for these populations were negative (Myers et al. 1998). South Puget Sound populations averaged 11,000 spawners for the same period and trends were mainly positive. Myers et al. (1998) concluded that chinook salmon in this ESU are not presently in danger of extinction, but they are likely to become so in the foreseeable future. Overall abundance of chinook salmon in this ESU has declined substantially from historic levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high.

The White River population of PS chinook salmon exhibits the basic characteristics and biological requirements of PS chinook salmon described in Myers et al. (1998). As described in section 2.1.1.2, the PSTRT has identified WR chinook salmon as an independent population of the PS chinook salmon ESU (PSTRT 2001). The PS chinook salmon ESU includes the White River spring chinook salmon hatchery stock and this hatchery stock is considered both listed and essential to recovery (Table 1 of 64 FR 14308).

White River chinook salmon populations include spring and summer/fall runs. The primary means of discerning between the two runs has been administrative, with fish arriving at the

Corps' Buckley fish trap before August 15 classified as spring chinook salmon and fish arriving later designated as summer/fall chinook salmon. Recent DNA studies of downstream migrating smolts and returning adults by WDFW suggest that the WR chinook salmon population comprises genetically distinct spring and fall stocks (Shaklee and Young 2002, pers. comm.).

Migrating fish enter the river from May to mid-September. Hatchery populations of WR chinook salmon spawn in September and October; radio-tagging studies by the Puyallup Tribe observed natural spawning in the White River and tributaries from early September through late October (Ladley et al. 2002). Spawning is known to occur in the upper basin in Huckleberry Creek, the Clearwater River, the Greenwater River, and the mainstem White River. Spring chinook salmon, as well as summer/fall chinook salmon, also spawn in the White River project bypass reach. Chinook fry emerge from January through March. Studies indicate that a significant portion of spring chinook salmon smolt (up to 80%) and migrate downstream in April and May as subyearlings (WDFW 1996; Dunston 1955).

Estuary rearing is considered to be important for chinook salmon that outmigrate as subyearlings, such as the WR chinook salmon (Groot and Margolis 1991). Outmigrating smolts feed, grow, and develop their ability to osmoregulate in saltwater during this period. Chinook salmon smolts have been observed in Commencement Bay from March through the end of June. Wild smolts from the White River, which outmigrate as subyearlings, are probably resident in the estuary from April to May (Kerwin 1999). The 20% of WR chinook salmon that outmigrate as yearlings are not believed to spend significant time in the estuary before migrating offshore. Very little data is available on the oceanic phase of the WR chinook salmon life cycle. White River chinook salmon return to spawn at ages of 2-5 years, with the majority of spawners 3-4 years old (WDFW 1996).

Pre-twentieth century levels of WR chinook salmon production and escapement are unknown. The most dependable source of information, trap counts at the Corps facility, started in 1941 with the construction of MMD, nearly 30 years after the White River project began operation. All past and current estimates of population size are based on trap counts. Earlier accounts from sportsmen in the 1930s note high numbers of chinook salmon in the river, but there were no systematic efforts to enumerate escapement (WDFW 1996). Trap counts indicate a steady decline in abundance of WR chinook salmon from 1942 through the mid-1980s (Figure 2-1). Decreases in abundance occurred in conjunction with increasing anthropogenic actions, including construction of MMD, intensive logging of the upper watershed, and continuing development and flood control efforts in the valley. Increasing counts have been observed following efforts to improve fish passage and survival, including increasing the minimum flows in the bypassed reach, improving fish passage at MMD in 1995, installing new fish screens at the PSE White River project in 1996, and releasing WR chinook salmon raised in captive broodstock and conventional hatchery programs in the 1990s.

Increasing trap counts in the 1990s have likely been influenced by the release of over 2 million unmarked, hatchery-reared WR spring chinook salmon between 1992 and 1999. Captive broodstock and conventional hatchery programs began in the 1970s. First efforts at rearing fish and releasing them in the White River were unsuccessful and off-site conservation programs were started. In 1990, smolt releases were resumed in the White River. Fish were held at acclimation sites in the upper basin then transported below the PSE diversion dam for release. The Muckleshoot Indian Tribe opened a hatchery near the site of the PSE Diversion Dam in 1989, using eggs from the conventional and captive broodstock programs. The first releases were in 1991 and the first adults returned in 1992. Off-site rearing is planned to be phased out when recovery goals are reached. Genetic studies have shown that naturally-spawned and hatchery-reared WR chinook salmon are very similar, suggesting a strong influence of the hatchery program on wild fish genetics (WDFW 1996). As stated above, the WR spring chinook salmon hatchery stock is considered part of the PS chinook salmon ESU, is listed as threatened, and has been determined to be essential for recovery (64 FR 14308).

The 1997 license order and BA overlook aspects of the project that are critical to an effects determination. While the White River salmon hatchery is the product of a settlement agreement between PSE and the Muckleshoot Indian Tribe, separate from the license proceeding, it remains relevant to the survival and recovery of White River and Puget Sound chinook salmon. Past actions of the project, in the form of river dewatering, sediment sluicing, and deficient bypass screens particularly, were significant factors for decline of the stock that contributed to an environmental baseline condition of a population so depressed it became listed as threatened under the ESA.

The run became so severely depressed that WR chinook salmon were cultured at both NOAA Fisheries facilities in Manchester and WDFW facilities at Minter Creek beginning in 1977 to preserve the population from extirpation. These actions were undertaken in direct response to the population decline that resulted, in large part, from project effects. As a result, intensive hatchery propagation, including captive broodstock, had to be used to avoid extinction (WDFW et al. 1996), and such propagation reduced the fitness of the composite natural and hatchery populations, compared to the fitness of the population prior to the project (Poon 2001, pers. comm.). If the project were decommissioned, and the river returned to pre-project conditions, termination of hatchery production is expected to result in the continued decline in fitness of the composite hatchery and natural population for a period of time. Hatchery propagation can be used to prop up the population to prevent extirpation while chinook salmon are reintroduced to the natural environment and given time to readapt to it (Ford 2001, pers. comm.).

When the White River hatchery was built, NOAA Fisheries and WDFW moved the chinook salmon to the new hatchery, located in the river basin to which the fish were indigenous. Prospect for recovery of the population seem improved by the presence and operation of the hatchery and increased minimum instream flows that commenced in 1987. That prospect is flawed in its assumption that the hatchery will be funded for operation. PSE provided funding through 1997, and the Muckleshoot Indian Tribe has funded operations since that time. The Tribe has indicated that it does not intend to fund hatchery operations indefinitely.

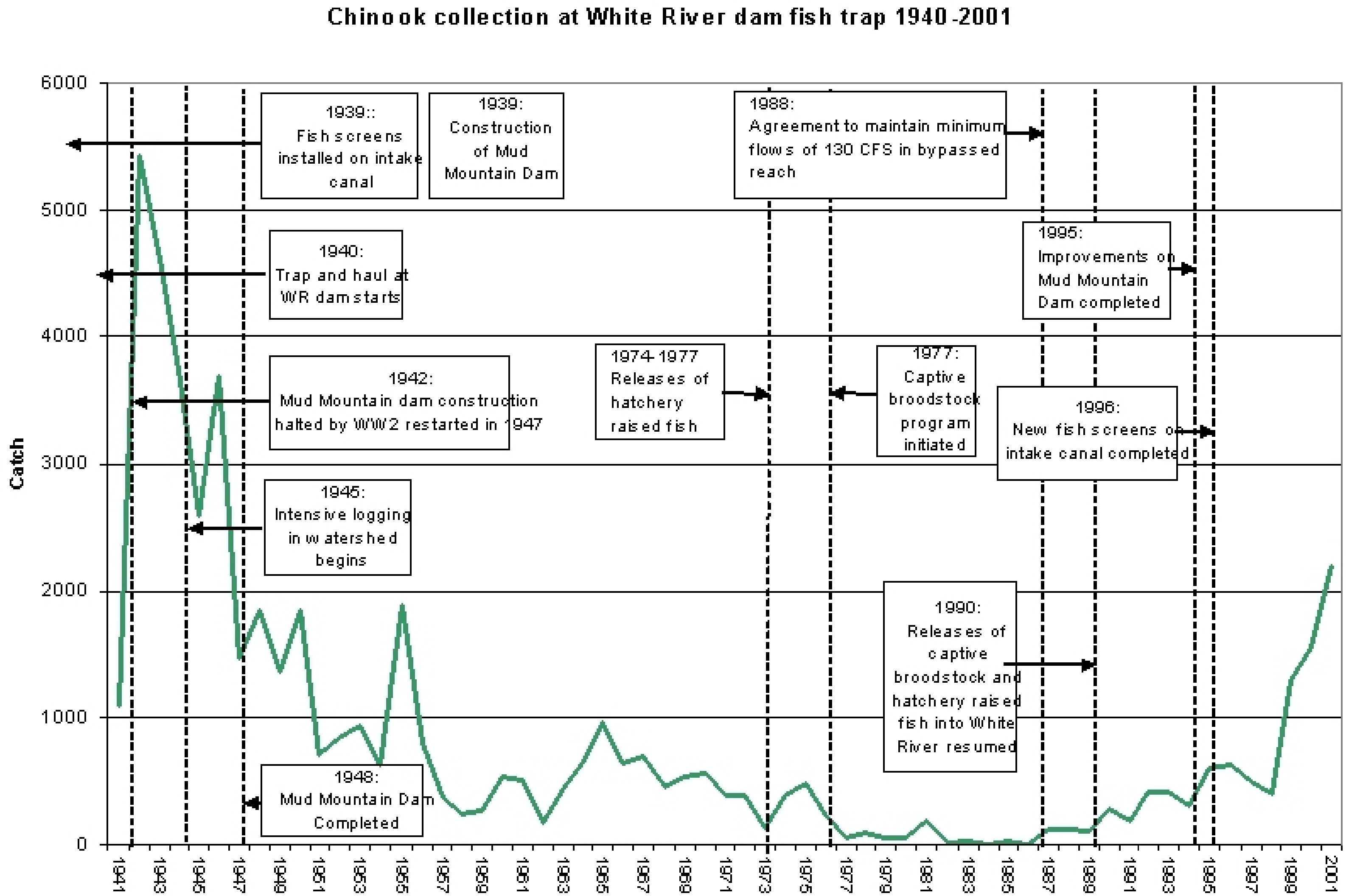
NOAA Fisheries concludes that project facilities and operations, although not the only factors, were among the more egregious factors leading to the decline and recent ESA listing of this stock within the ESU.

The exploitation rate of WR chinook salmon prior to the release of specific tag groups is unknown, but has been generally estimated by harvest managers at WDFW and NOAA Fisheries as averaging 69% from the years 1979 to 1990, 49% from 1991 to 1993, and 16% in 2000 (NMFS 2000). High exploitation rates were common to most, if not all, PS chinook salmon stocks, wild and hatchery alike. However, only the WR population fell to such critically low status that the fishery managers felt it necessary to take the population into "protective custody" and culture it at locations outside the degraded habitat influences within the White River. Much of the harvest has occurred in mixed stock fisheries, where WR chinook salmon are mixed with numerous other populations. Some of the other populations were then subjected to additional terminal area fisheries during the 1970s and 1980s, a period of time when almost no terminal harvest of WR chinook salmon occurred, in large part because the run was so small that it no longer produced a significant number of spawners, let alone any harvestable surplus. The last significant terminal area harvest of WR chinook salmon appears to have been in 1972, yet harvestable returns of wild chinook salmon returned to other Puget Sound rivers during the 1970s in spite of relatively high mixed stock harvest rates. Not surprisingly, the weakest chinook salmon populations occur where the combined effects of both harvest and habitat degradation are most severe.

Harvest rates of WR chinook salmon have been reduced from an estimated average of 69% to 16% to assist the survival and recovery of the species. The habitat of the White River remains in not properly functioning condition (PFC), due in significant respect to the operations of the White River Hydropower Project (Table 2-2). Harvest issues have been, and are being, dealt with to very significantly reduce adverse effects on chinook salmon. Properly functioning habitat is also necessary to the survival and recovery of WR chinook salmon. The White River project imposes the most severe adverse effects on the habitat in the form of dewatering, degraded water quality, and flow fluctuations (Table 2-2). The project diversion is now screened.

The highest chinook salmon returns to the Buckley trap occurred during 1942 and 1943, after the White River Hydropower Project was developed and operating for many years. Interestingly, for the period of record, all the highest recorded returns of WR chinook salmon at Buckley occurred during World War II. This may have been the result of a reduction in harvest rates, less habitat perturbation, or coincidentally high marine survival rates. Returns were significantly lower both before and after the war.

Figure 2-1. Annual collection of WR chinook salmon at the Corps White River Diversion Dam trap 1976-2001.



2.1.1.4 Environmental Baseline in the Action Area

The environmental baseline includes "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone Section 7 consultation and the impacts of state and private actions that are contemporaneous with the consultation in progress" (50 CFR 402.02). In step 2 of NOAA Fisheries' analysis, we evaluate the relevance of the environmental baseline in the action area to the species current status. In describing the environmental baseline, NOAA Fisheries emphasizes important habitat indicators for the listed salmonid ESU affected by the proposed action. The action area is described in section 2.1.1.1 of this document. NOAA Fisheries does not expect any other areas to be directly or indirectly affected by the proposed action.

2.1.1.4.1 Habitat and Fish Distribution Within the Action Area

The White River originates at the base of Winthrop, Emmons, and Fryingpan glaciers on Mount Rainier. From its origins in the Cascade Mountains, the river drops to the Puget Sound lowlands, joins the Puyallup River, and drains into Puget Sound at Commencement Bay. The White River receives flow from 55 identified tributaries, the largest ones being the Clearwater and Greenwater rivers. The White River drainage basin area is 494 square miles (Kerwin 1999; WDFW et al. 1996).

Currently, the White River is a tributary of the Puyallup River which empties into Commencement Bay near Tacoma, Washington. Prior to 1906, the flow of the White River split into distributaries near Auburn, Washington, with varying volumes of the river (depending on the abundance and distribution of flood-born logjams) flowing northerly into the Green River (which drains into Elliot Bay near Seattle, Washington) and southwesterly via the Stuck River, and then to the Puyallup River. Flooding and human activities resulted in the entire flow of the White River flowing down the Stuck River channel in 1906. This route was later reinforced with permanent structures to prevent reconnection with the Green River.

The White River flows through a series of glacial deposits and the remains of the Osceola Mudflow, which covers the White River valley to a depth of 25 feet. The geologically recent mudflow of approximately 5,700 years ago characterizes the White River as a "young river." As such, it is still in the process of cutting a channel through the mudflows and is characterized by steep gradients, heavy sediment loads, and in places, a deeply incised channel. Sediment input from glaciers at the headwaters adds to the amount entrained by erosion as the White River cuts through the mudflow and ancient glacial sediments. Estimates of annual suspended sediment transport range from 440,000-1,400,000 tons (WDFW et al. 1996). The name "White River" reflects the turbid appearance of the river caused by high levels of suspended glacial sediments during the summer months. There is a visible gradient at the mouth of the White River as its milky waters join the darker waters of the Puyallup River.

The White River channel is considered to be inherently unstable (WDFW et al.1996). This is the result of large suspended sediment load, its deposition as the river enters the gentler gradients in the valleys (filling existing channels), and the relative ease of cutting new channels through the remains of the Osceola Mudflow. The White River basin receives large amounts of water from heavy precipitation during winter months and from snowmelt in the spring through summer. Since the watershed includes elevations in excess of 4,000 feet, there is typically a heavy snow pack and occasional rain on snow events. Sustained flows are typically highest during May and June and lowest in September and October. Mean flows at Buckley, Washington, are 1440 cfs, although historic peak flows have reached as high as 17,000-28,000 cfs before the construction of Mud Mountain Dam (USGS 2000). Given the highly variable flows of the river in response to rainfall and snowmelt and the unstable nature of the river channel, it is not surprising that the White River valley has historically been subject to severe floods.

Although its description may lead one to postulate that it would be challenging for fish to survive in the White River, spring and fall chinook, coho, chum, and pink salmon, and steelhead and bull trout are native to the drainage. Evaluations of salmonid habitat list unstable banks and shifting channels, cold stream temperatures, and high turbidity, which limits aquatic productivity, and heavy deposits of glacial silt covering potential spawning gravels as natural potentially limiting factors (PSP&LC 1987). However, the last factor noted may not be a significant problem. Most chinook salmon appear to favor spawning in non-glacial tributaries of the White River, including the Clearwater River, Huckleberry Creek, and the Greenwater River, although spawning also occurs in the mainstem White River. Spawning substrate was rated as "good" in 93% of samples from the Clearwater River, 71% of samples from Huckleberry Creek, and 42% of samples from the Greenwater River, with the remainder rated as "fair" or "poor" (Keown 1998).

PSE concluded from historical anecdotal records of government officials and citizens that the turbidity and heavy sediment load of the White River rendered the stream unproductive for fish (PSE 1987). PSE also consulted with University of Washington fisheries professors Dr. Ernst Salo and Dr. William F. Royce. Dr. Royce, in consideration of the heavy sediment load from the glaciers and their valleys, pronounced the White River as "...essentially useless for all salmon spawning for all life during the critical spring season when the flows are so high and the sediment transport so great" (PSE 1987). In his 1972 report to the Muckleshoot Indian Tribe, Dr. Salo concluded that the mainstem of the White River "...was of poor quality for spawning and rearing..." and further indicated that "glacial or turbid streams produce fewer fish than clear-water streams" and that "the sediment loads of the White River are the controlling influence on salmonids in the drainage" (PSE 1987). PSE (1987) reports additionally that Professor Thomas Dunne, University of Washington, Geology, further characterizes the extreme nature of suspended and bedload sediment transport in the White River and channel instability as significantly affecting fish habitat.

While we expect that glacial and heavily sediment laden river basins may be less productive on a unit area basis, we note that other glacial rivers in western Washington that also carry heavy sediment loads and have reaches of significant channel instability, specifically the Nooksack, Skagit, Puyallup, Nisqually, Cowlitz, Lewis, Hoh, and Queets, are, or all were, significant producers of natural spring and summer/fall chinook salmon populations. The White River has produced thousands of returning adult chinook salmon annually according to Corps' records from the Buckley fish trap, and it does not seem sufficiently different to us from other chinook salmon rivers to not include it in the ever-diminishing inventory of significant habitat for chinook salmon.

Numerous expert opinions were collected by PSE, which, on casual reading, suggest that the White River is all but unfit for salmonid habitation. A common thread of these reports is the absence of direct observations of fish or the interrelationship between this adverse environment and the fish it supports. Surveys by the Muckleshoot and Puyallup tribes document the persistent utilization of the bypass reach of the White River for both spawning and rearing by chinook salmon and other species. A freeze-core analysis of White River substrate in the bypass reach by PSE sampled 28 cores, of which four contained salmon eggs or alevins (PSP&LC 1989). The report concludes that "Based on visual inspection...it appeared that the amount of fines present in many of the cores could adversely affect incubation of eggs and or emergence of fry. However, the values of indices that were calculated generally did not fall in the range that would predict high mortality rates." NOAA Fisheries believes this indicates that the White River is not fundamentally different from other glacial rivers that support chinook salmon.

The White River Spring Chinook salmon recovery plan (WDFW et al. 1996) records that the White River was historically a very productive system based on high numbers of adult spring chinook salmon caught in the trap (peak 5,000) in the 1940s. These returns occurred after the White River project, which caused significant losses of downstream migrating smolts, had operated with an unscreened intake for 27 years (1912-1939). The continued survival of salmon populations in this river (albeit in greatly reduced numbers) even in the face of significant habitat degradation, barriers to migration, and other anthroprogenic impacts, suggests that the White River is well suited for salmonid fishes, that in turn are apparently suitably adapted to prevailing White River environmental conditions.

2.1.1.4.2 Current Conditions, Including Factors for Decline

The discussion of the current condition of the White River is divided into three geographic sections. The divisions reflect changes in not only the physical character of the river but the salmonid life stage and human activities associated with it. These human activities represent likely factors for decline of the species. The first section is from the headwater origins to the upper end of MMD reservoir. The second section describes the reach from the head of Mud Mountain reservoir to the mouth of the White River, and the third area is from the White River's confluence with the Puyallup River to the estuary in Commencement Bay.

Headwaters, from Upstream Limits of Salmon Distribution to the Head of Mud Mountain Dam Reservoir

The upper White River basin is characterized by high gradients and is surrounded by the steep forested slopes of the Cascade Mountains. Land ownership is distributed among private forest lands, the National Forest, and Mt. Rainier National Park. The areas outside the national park have been heavily logged since the 1940s. The interagency recovery plan for WR spring chinook salmon (WDFW et al. 1996) notes that logging has played a significant role in diminishing stream productivity in the White River basin. Comparison of aerial photographs of the Greenwater River taken in 1962 and 1992 illustrate the effects of 30 years of clearcut logging and road building. Before logging operations, the channel was typified by a narrow meandering stream bordered by late successional forest which often formed a complete canopy over the stream. The later photographs show the formation of large gravel and sandbars throughout the channel, loss of meanders, pools, and large woody debris. River meander patterns have been affected by logging in riparian zones, stream debris clean-out programs, and road construction within the floodplain (WDFW et al. 1996). The U.S. Forest Service (USFS) estimated current (1993) successional forest stages to be less than 5% late seral (3-32% historic), 62% mid seral (8-97% historic), and 20% early seral (0-87% historic) (Kerwin 1999; USFS 1995). Road density in the upper basin is described as light (Kerwin 1999). However, there are impacts from erosion and channel constriction by streamside roads and bridges. There are also road-associated barriers to anadromous fish migration identified on 5 tributary creeks (Kerwin 1999). There have been a number of reforms in logging practices in recent years as well as directed efforts at road decomissioning and stream restoration. These efforts appear to be at least somewhat effective and should lead to an increase in habitat quality and quantity over time in the upper watershed.

Middle Reaches, from Mud Mountain Dam Reservoir to the Mouth of the White River

From the head of the MMD reservoir at RM 32.6 to its confluence with the Puyallup River, the White River and surrounding landscape changes character. The steep hillsides of the upper basin give way to valley floor. The character of human activities also changes, from logging to agricultural, industrial, and residential activities. Land usage in the lower White River basin is a mix of flood control reservoir, forestry, agricultural, hobby farms, rural residential, suburban, urban, hydroelectric, and industrial. Land ownership is mostly private.

Mud Mountain Dam was built from 1940-1948 with a halt in construction activities during World War II. At the beginning of construction, a trap and haul operation was begun at the pre-existing fish ladder at the White River Hydroelectric Project diversion dam to transport upstream migrating salmonids above MMD. Since there are no fish passage facilities at MMD, trap and haul operations have continued at this location to the present time. Downstream passage during the construction period was provided by a 23-foot-diameter free- flowing tunnel. The primary purpose of MMD is flood control, so no permanent reservoir is present. It is run as an "empty pool" to allow room for storage of flood waters. Mud Mountain Dam also traps most woody debris and stores sediment when storing water, which interferes with the downstream channel dynamics. The Corps removes accumulated wood from the reservoir periodically. Stored sediment from high flow events is flushed from the reservoir at discharges much lower than the flow volumes that originally transported it to this river reach. Consequently, it appears that much of the sediment is deposited in more upstream portions of the stream channel, rather than being transported to the lower river or bay. This information was provided anecdotally by fisheries biologists familiar with the river from performing regular fish and habitat surveys. While not a certain conclusion, it is the common impression of fisheries people most familiar with the river.

In addition to being a total barrier to upstream passage, MMD presented a significant obstacle to successful downstream migration of smolts as well. The original configuration of the dam included Howell-Bunger valves on the outlet. These valves pressured the water into a spray to reduce erosion in the tailrace. These valves and associated hardware are believed to have caused high levels of downstream migrant mortality. In 1995, a series of fish passage improvements were completed, including removal of the Howell-Bunger valves and projecting objects from the tunnel, and installation of a tower to make it easier for downstream migrants to find the outlet at various pool elevations.

Downstream of MMD the character of land use changes. Numerous farms and the towns of Enumclaw and Buckley are located in this reach. Both towns discharge effluents from their sewage treatment plants into the reduced flows of the White River project's bypassed reach, which is described below. Additional non-point source pollution enters from agricultural activities, including numerous dairies, along this reach. The White River downstream of MMD exceeds DOE standards for fecal coliform pollution, temperature, and pH. Barreca and Erickson (2002) concluded that the high pH (>9.0) that is sometimes observed in the bypassed reach is caused by photosynthetic activity of the high levels of algae fostered by nutrient input from the previously mentioned point and non-point sources. The relationship between streamflow and pH level is discussed in the effects section regarding water quality.

The initial licensing of the White River Hydroelectric Project is the subject of this Opinion and details of ongoing effects of the proposed action are described in section 2.1.2 of this Opinion. The White River project, although never licensed, has operated since 1912. Therefore, historical effects that have contributed to the current status of WR chinook salmon are briefly reviewed in the context of the environmental baseline.

The White River project diversion dam diverts water from the White River into the project intake canal or "flowline." Currently, PSE claims a water right to 2000 cfs, equal to the maximum capacity of the flowline (actual capacity is somewhat reduced due to sediment buildup). Although this amount would be sufficient to entrain the entire river flow for much of the year, a Pierce County Superior Court decision in 1910 required minimum flows to the bypassed reach of 30 cfs. Since 1988, PSE has operated under an agreement with the Muckleshoot Indian Tribe which requires that no less than 130 cfs (with 7,240 acre feet for supplementary flows annually) is released into the 21-mile-long bypassed reach to support salmonid rearing and migration (WDFW et al. 1996). Flows in excess of flowline capacity flow into the bypassed reach and there have been frequent failures of dam flashboards (intended by design) that allowed higher flows to pass down the bypassed reach. The Corps has operated a fish trap located at the diversion dam since 1941 to facilitate passage of fish above MMD. The diversion dam functions as a support structure and weir, blocking upstream passage and guiding fish toward the ladder leading to the trap.

From the start of operations in 1912 until 1939, the intake channel was unscreened. Since most of the White River flows were diverted most of the time, a high proportion of the downstream migrating smolts likely were entrained into the project flowline during this period. After entering the intake they would pass downstream to Lake Tapps. The only exit from Lake Tapps is through the powerhouse turbines, which results in an estimated mortality rate of 50% (Rochester et al. 1984 as cited in FERC 1992; Ruggles et al. 1981). In 1939, a large rotating drum fish screen was installed, and although an improvement, it was less than completely effective (Regenthal 1953). The estimated screening efficiency was 50%-60%, with a high potential for injury to fish during travel down the return flume to the river (Regenthal 1953). The remaining 40%-50% of fish that passed along the screen into the intake system were estimated to have a 70% mortality rate (Heg 1953a, 1953b, 1954, 1955). New screens were completed in 1996. Effects of the current screens are discussed in section 2.1.2 of this Opinion.

The bypassed reach, which begins at the White River project diversion dam, has been affected by the seemingly contrary problems of low flows and flood control operations. From 1910 to 1988, the minimum flow in the bypassed reach was 30 cfs, although when flows exceeded intake capacity (2000 cfs), excess flow was sent down the bypassed reach. There were also occasional dam failures which allowed more water to pass down the reach until the flashboards could be repaired. This reach is also subject to extreme variation in flow when the intake channel is shut down for maintenance, potentially going from 30 cfs (180 cfs after 1998) to over 2,000 cfs and then back to 30 cfs (180 cfs after 1998) very rapidly. A significant fish kill occurred in September 2000 following just such a stream flow manipulation as part of the project's maintenance outage. Another, more extensive kill occurred in April 2003 when the river's flow was reduced from 1,600 cfs to 200 cfs to repair and replace flashboards. Less significant fish kills have been informally reported to NOAA Fisheries following most stream flow change events since the September 2000 incident.

Flow reductions within the bypass reach have adversely affected fish habitat by dewatering otherwise useable area, disconnecting side channel and off channel habitat, and limiting habitat maintaining and forming processes, including sediment and woody debris transport. Upstream and downstream migration has been inhibited by reduced flows, as described in section 2.1.2 of this Opinion. Total suitable spawning habitat has been reduced, particularly spawning habitat far from the channel thalweg (the deepest line of highest water velocity). This habitat type is critically important in a system with highly variable flows like the White River, since redd scouring and egg mortality during high flow events is less likely in redds well removed from the thalweg.

An intermittent barrier to passage through the bypass reach is the City of Tacoma water pipeline crossing. It is a large-diameter iron pipe buried in the streambed, supported on its downstream side by a dam-like concrete structure. There is a fish ladder located in the middle of the structure, but it is only effective at a limited range of flows. There have been other obstacles to fish passage associated with the pipeline crossing, including protruding rebar, the ends of which were sharpened by stream action and abrasive sediment. This has recently been partially corrected by maintenance activities. Although plans were made to replace the crossing in 1999, construction was delayed and there are now plans to replace the pipeline in the summer of 2003.

The project tailrace affects the timing and volume of water returned to the lower White and Puyallup rivers by storing water in Lake Tapps and releasing it according to the energy generation schedule. Water quality of the tailrace discharge at times does not meet state standards for dissolved oxygen and water temperature. These are discussed in detail in the effects section of this Opinion.

The bypassed reach and lower White River have also been subject to flood control modifications, including diking and gravel removal to deepen the channel. Control of flooding by MMD has led to extensive development of the lower river floodplain from Auburn downstream. This development has increased with the shift from agricultural land use to residential, urban, and industrial uses.

Returns of adult chinook salmon dropped so low in the 1970s that NOAA Fisheries and WDFW initiated captive broodstock programs at separate facilities outside the White River subbasin in an effort of avoid extirpation of the stock. Although the hatchery action over two decades is believed to have contributed to reduced stock fitness for survival in the natural environment, the agencies considered that alternative preferable to the possible loss of the stock (Poon 2001). As a result of an agreement with PSE, the Muckleshoot Indian Tribe began operating a fish hatchery on the White River located adjacent to the site of the project's diversion dam. NOAA Fisheries transferred its stock of WR chinook salmon and WDFW transferred about half its supply to the Muckleshoot Indian Tribe for fish culture and restoration action in the White River subbasin. Most of the chinook salmon presently returning to the White River are believed to be the result of the hatchery practices (Tynan 2002, pers. comm.). Until recently, unmarked juvenile hatchery chinook salmon were stocked in the upper watershed, and it has not been possible to discern what proportions of the adult return result from natural and artificial production. That action has been modified so that future returns can be evaluated according to production origin.

The hatchery spring chinook salmon are part of the listed ESU and continue to be cultured at the PSE/Muckleshoot hatchery. However, the Muckleshoot Indian Tribe has indicated they do not intend to fund this fish culture program indefinitely. The presence of hatchery chinook salmon and hatchery operation is part of the environmental baseline, but it is not part of the proposed licensing action. Discontinuation of this hatchery program is discussed under the cumulative effects section.

NOAA Fisheries has completed other Section 7 consultations on proposed project actions in this part of the White River subbasin. The Bureau of Indian Affairs and the Muckleshoot Indian Tribe consulted on a plan for a proposed amphitheater on the plateau above the bypass reach of the river. Results of that consultation include provisions to protect water temperature in a small tributary stream to the White River. The City of Tacoma's Water Department consulted on a proposal to replace their buried waterline that crosses the White River and remove the concrete dam that forms a partial barrier to upstream migration. The proposed action is now planned for the summer of 2003.

Lower Reaches, from the White River Confluence to the Estuary

The White River flows into the Puyallup River near Sumner, Washington, nearly doubling the volume of the Puyallup. Downstream of the White River confluence, the river channel is constrained by roads, dikes and armored banks. Urban and industrial development predominate as the river flows downstream past the towns of Puyallup and Fife. The estuary is surrounded by Tacoma, the third largest city in Washington. The Puyallup River estuary is known as Commencement Bay and is the site of the Port of Tacoma. The heavy industrial use has included a large amount of channel dredging and water pollution in the waterway and bay. Approximately 98% of historical wetland area has been lost and Commencement Bay is listed as an Environmental Protection Agency Superfund pollution clean-up site. Loss of river-transported sediments and organic matter, critical to estuary functions, from the effects of Mud Mountain Dam and the White River Hydroelectric Project, may have contributed to the loss of estuary productivity. Although channel dredging and dikes limit the possibility of new wetland formation, there are currently efforts to improve water quality and restore some wetland habitat. However, since the Port of Tacoma (a large part of which is located in the estuary) is critical to the economics of the Tacoma area, it seems unlikely that the estuary will ever be restored to more than a small fraction of its historical size and productivity.

2.1.1.4.3 Summary

The habitat biological requirements of the PS chinook salmon ESU are not being met under the environmental baseline. Environmental baseline conditions in the action area would have to improve to meet those biological requirements not presently met. Any further degradation or delay in improving these conditions might increase the amount of risk the listed ESUs presently face under the environmental baseline. Table 2-2 displays a summary of the relevant factors discussed in the above sections, based on the *Matrix of Pathways and Indicators* described in NMFS (1996).

Table 2-2. Matrix of Pathways and Indicators for the environmental baseline. (H) indicates reaches upstream of the Mud Mountain Dam, (M) indicates reaches from Mud Mountain Dam to the mouth of the White River, (L) indicates reaches downstream of the confluence of the White River to the Puyallup River estuary. Function codes: PF: properly functioning; NPF: Not properly functioning; AR: At Risk. Criteria for each determination are from NMFS (1996) unless otherwise noted.

Path way	Indicator	Function	Description	Source
Water Quality	Temperature	NPF	Clearwater and Greenwater rivers (White River tributaries), bypassed reach, and reaches downstream of tailrace exceed WDOE water temperature standards for salmon spawning and rearing (WDOE 1998)	Logging and roadbuilding loss of riparian shading reduced flows in bypassed reach
	Sediment/	AR	Increased sediment input from erosion of logging roads and clearcut slopes, though river naturally has high turbidity levels from glacial sources. AR, rather than NPF, because turbidity increase is only "moderate" compared to natural levels	Intensive logging practices
	Contamination	NPF	Reaches downstream of Mud Mountain Dam exceed DOE fecal coliform, pH, copper and mercury standards (WDOE 1998) High levels of toxic chemicals in estuary, classified as EPA superfund site	Unclear, potential agricultural, residential and urban sources upstream Industrial development in estuary and lower basin

Table 2-2. Continued

Pathway	Indicator	Function	Description	Source
Habitat Access	Barriers	AR	Some road crossings with impassable culverts in upper watershed No fish passage facilities on Mud Mountain Dam (partially mitigated by trap and haul) No fish passage facilities on White River Diversion dam Dams (partially mitigated by trap and haul). Low flows in bypassed reach inhibit upstream and juvenile migration. [Note: details regarding White River passage effects are in section 2.1.2 of this Opinion]	Logging roads Mud Mountain Dam White River Project
Habitat Elements	Substrate	AR	Substrate transport Blocked by Mud Mountain Dam, Substrate transport blocked by White River diversion dam and substrate entering the intake channel is trapped and removed	Mud Mountain Dam White River Project
	Large Woody Debris	AR	LWD transport blocked by Mud Mountain Dam and White River Diversion Dam	Mud Mountain Dam White River Project

Function codes: PF: properly functioning, NPF:Not properly functioning AR: At Risk

Table 2-2. Continued

Pathway	Indicator	Function	Description	Source
Habitat Elements	Pool Frequency/Quality	NPF	Pool frequency listed as limiting in upper reaches because of intensive logging practices (Kerwin 1999) Low pool frequency in bypassed reach due to reduced flows and lack of pool forming processes Simplified channel in lower White and Puyallup River due to bank stabilization flood control projects	Logging and road building Mud Mountain Dam White River Project Flood Control projects
	Off-Channel Habitat	NPF	Off-channel habitat rare in upper reaches due to intensive logging practices Reduced flows in bypass reach do not fill off-channel habitat during critical life history periods Simplified channel and armored banks for flood control	Intensive logging practices White River Project Flood control projects

Function codes: PF: properly functioning, NPF:Not properly functioning AR: At Risk

Table 2-2. Continued

Path way	Indicator	Function	Description	Source
Habitat Elements	Refugia	NPF	Rare due to low channel complexity and lack of large woody debris	Intensive logging practices, Mud Mountain Dam White River Project Flood Control projects
Channel Dynamics	Channel Morphology	NPF	Flood control dikes surround channel in lower White and Puyllup Rivers, channel forming process inhibited by changes in flows and sediment transport from upstream dams	Intensive logging practices Mud Mountain Dam White River Project Flood control projects
	Streambank Condition	NPF	Eroded banks in upper watershed (Kerwin 1999)	Intensive logging practices
	Flood plain Connectivity	NPF	Lower reaches of White and Puyallup constrained by dikes in most areas Agricultural, residential and industrial development of flood plain	Flood control projects, development

Function codes: PF: properly functioning, NPF:Not properly functioning AR: At Risk

Table 2-2. Continued

Pathway	Indicator	Function	Description	Source
Channel	Altered Flows	NPF	Reduced base flows in bypassed reach during important life history periods and altered patterns of peak flows throughout the system, due to flood control at Mud Mountain and diversion at the White River Project	Mud Mountain Dam White River Project
Watershed Conditions	Increase in Drainage Network	NPF	Increased drainage network associated with agricultural and urban development of lower watershed	Urban and agricultural development
	Road Density and Location	NPF	Network of unpaved logging roads and some paved roads in upper watershed. Extensive series of paved roads in lower watershed	Logging, Urban development

Function codes: PF: properly functioning, NPF:Not properly functioning AR: At Risk

Table 2-2. Continued

Path way	Indicator	Function	Description	Source
Watershed Conditions	Disturbance History	NPF	High disturbance from logging and development in unstable upland and riparian areas. Very little late successional or old growth forest in upper watershed.	Logging, Flood control, Mud Mountain Dam, White River Project, Industrial Development, Agricultural Development, Residential Development
	Riparian Reserves	NPF	Mostly early sucessional stage forest in upper watershed, few large conifers Very few remaining areas of forest in lower watershed, riparian reserves mostly limited to trees bordering the river	Intensive logging practices Agricultural, Industrial and Residential Development

Function codes: PF: properly functioning, NPF:Not properly functioning AR: At Risk

2.1.2 Analysis of Effects of Proposed Actions

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR 402.02). Direct effects occur at the project site and may extend upstream or downstream based on the potential for impairing important habitat elements. Indirect effects are defined in 50 CFR 402.02 as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." They include the effects on listed species of future activities that are induced by the proposed action and that occur after the action is completed. "Interrelated actions are those that are part of a larger action and depend on the larger action for their justification" (50 CFR 403.02). "Interdependent actions are those that have no independent utility apart from the action under consideration" (50 CFR 402.02).

2.1.2.1 Effects of Proposed Action

In step 3 of NOAA Fisheries' jeopardy approach, we evaluate the effects of proposed actions on listed salmon and steelhead in the context of whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed (or continuing) action. The action also must restore, maintain, or at least not appreciably interfere with the recovery of the PFC of the various fish habitat elements within a watershed.

2.1.2.1.1 Effects of the Diversion Dam

The existing diversion dam is an outdated structure. It includes flashboards that are designed to fail at high river flows, which can hinder the function of the fishway. Listed chinook salmon may continue to be injured or killed by the substandard facility. Continued operation of the diversion dam will result in continued adverse effects that include:

i. Direct injury and mortality from the poor dam apron condition.
ii. Substandard design characteristics for leading salmon to the fish ladder entrances.
iii. Deterring some salmon from using the ladder, causing them to spawn in the immediate vicinity of the diversion dam, rather than dispersing throughout otherwise available habitat of better suitability.
iv. Minimum instream flow to the bypass reach is secondary to diversion to the project flowline due to the gate structure.
v. Blocks large woody debris transport to bypass reach and lower river.
vi. Blocks sediment transport to bypass reach and lower river.

The wooden dam apron is in disrepair and has the potential to injure salmon on protruding metal. Fish may become fatally trapped between broken boards. Flashboards wash out at nearly every high water event, compromising the function of the fish ladder to guide migrating salmon into the trap and haul facilities. When the flashboards wash out, migrating salmon can swim upstream without encountering the fish ladder, with no other way upstream past MMD. The fish ladder and its associated trap and haul facility that is operated by the Corps is the only means of upstream passage beyond MMD.

The spawning habitat in the vicinity immediately downstream from the diversion dam is not exceptional, yet significant numbers of salmon are reported to spawn there according to Muckleshoot and Puyallup tribal surveys (Ladley 2002). This is a potential indicator that adult salmon either are not leading well to the fish ladders or are otherwise dissuaded from using them.

The diversion dam includes no specific mechanism to maintain instream flow in the bypass reach. Consequently, natural variation in river flow and every change in flowline diversion subjects the bypass reach flow to readjustment and possible reduction. It appears that the bypass reach minimum flows will not be secure unless the diversion dam is reconfigured to provide first water to the fish ladders and instream flow and delivering second priority water to the project flowline. The diversion dam has no features to ensure or aid the transport of large woody debris and streamborn sediment into the bypass reach, although both can pass over portions of the weir crest.

License articles 302 and 401 require cofferdams to be consistent with approved designs and erosion control plans and measures for new construction and modification of existing structures. However, neither these or other license articles specifies that the project diversion dam will actually be renovated or reconstructed. Lacking an adequate diversion dam, listed chinook salmon may continue to be delayed, dissuaded from using, injured, or killed by the substandard facility. Furthermore, when flashboards blow out due to high flows, or if the dam itself is washed away by high river flows, chinook salmon could migrate upstream past the diversion dam site, missing the fish ladder. The fish ladder and its associated trap and haul facility that is operated by the Corps is the only means of upstream passage beyond MMD.

The project description at page 4 of the license contemplates modifications of the diversion dam, and FERC's order mentions diversion dam improvements under the subsection of new facilities. However, there is no license article nor any other license mechanism that assures either diversion dam renovation or reconstruction. Therefore, the effects analysis must consider the likelihood that the existing project diversion dam of timber crib construction will continue to operate for the next 50 years under the prospective license.

The measures described in articles 302 and 401 would reduce, but not preclude, erosion and sedimentation of the river channel. The probable construction season overlaps the chinook salmon spawning season, and significant numbers of chinook salmon spawn in the area immediately downstream of the diversion dam. Consequently, there is a reasonable likelihood of direct take of incubating chinook salmon eggs through sediment deposition in that river reach when incubating eggs are present.

Estimating the loss from this action is impossible. Most of the chinook salmon population seems to spawn upstream of MMD, and these fish are not likely to experience adverse affects from sediment release, unless its timing, duration, or lack of a suitable dam prevents the chinook salmon from entering the fish ladder and trap. Of those chinook salmon that spawn downstream of the diversion dam, it is unknown what proportion will be affected by sediment deposition for two reasons. First, glacial turbidity of the water precludes accurate surveys of the number of spawning chinook salmon, but spawning chinook salmon and their spent carcasses, incubating eggs, and emergent fry have all been observed. Second, it is unknown how far downstream the lethal effects of the sediment deposition might extend, and it is impossible to separate mortalities from this effect from others that are common to incubating salmon eggs and alevins. Spawning survey information from the Muckleshoot and Puyallup tribes indicate that more chinook salmon spawn in the upper half of the bypass reach than the lower, which is consistent with our own habitat evaluation that the upper portion is better suited to chinook salmon reproduction than the lower, given adequate streamflow.

Take of listed chinook salmon would occur as an acute effect whose duration should be limited to the construction and spawning/incubation season in which it occurs. No long-term effects are predicted from this construction activity, but long-term adverse effects that jeopardize chinook salmon could result if the dam is not renovated or reconstructed. If FERC requires reconstruction or replacement of the diversion dam, the long-term effects are expected to be beneficial to chinook salmon. A new dam would provide more precise flow control and not be subject to the loss of flashboards and hydraulic control as happens under existing conditions. With a new structure, chinook salmon would also be expected to benefit by the absence of protruding rebar, broken or missing apron boards, or other structural parts that injure fish or cause mortality.

Sedimentation is addressed in license article 402, which implements PSE's Sediment Disposal Plan, dated June 28, 1990. The authorization of any sediment disposal back to the bypass reach, without the river flow that originally delivered it to the project flowline, may adversely affect listed chinook salmon. Returning sediment to the bypass reach without sufficient water to disperse it or carry it through the river system, could adversely affect incubating chinook eggs or alevins, or otherwise interfere with the normal and effective rearing and migration of the listed salmon. FERC has on-site and off-site alternatives for sediment disposal that do not include discharging sediment from the flowline or its settling basins to the bypass reach of the river.

PSE investigated fine sediments and substrates in the bypass reach (Hosey 1989), observing that streambed materials are relatively coarse in areas used by spawning salmon. Calculated indices generally did not fall within the range that would predict high mortality rates to incubating eggs and alevins, although the amount of fines in many of the samples could have adversely affected eggs and/or fry emergence. While not conclusive, the clearest indication is that the White River is not sediment deficient, and actions that exacerbate fine sediment levels are not called for.

The condition that includes WR chinook salmon as threatened as part of the PS ESU is established in the environmental baseline section of this Opinion. The WR chinook salmon are genetically distinct from other PS chinook salmon stocks (WDFW et al. 1996; Marshall 1994) and are the only south Puget Sound stock exhibiting the early timed spring chinook salmon characteristic. NMFS (1999a) and WDFW consider the value of WR chinook salmon in maintaining biodiversity among PS chinook salmon stocks as very high. This is corroborated by the PSTRT (2001) and WDFW (1992).

The survival and recovery of WR chinook salmon is contingent on many things, chief among them being unimpeded access to and from the sea. Upstream access to critical spawning and rearing habitat is impeded by the project diversion dam, and MMD, five miles upstream. The functionality of the diversion dam is critical to the utility of the fish ladder and trap and haul facilities operated by the Corps. Absent reliable functioning of the diversion dam, WR chinook salmon lack access to a major part of their range in the river basin. Limiting access to the river reach downstream of MMD would drastically reduce the supply of habitat for critical life history stage phases of spawning and rearing. A finding of no jeopardy is dependent upon meeting the biological needs of the species and access to spawning and rearing habitat is clearly one of those needs. While the prospective actions of the license address these significant issues, it is not clear that the WR chinook salmon possess sufficient remaining resilience to survive and recover in the absence of augmentation from artificial production (Tynan 2002, pers. comm.).

2.1.2.1.2 Effects of the Intake Channel

Juvenile chinook salmon and other species originating from the upper White River basin must travel downstream through the Corps' MMD even before arriving at Puget's diversion dam. The Corps modified the MMD discharge tunnel in 1995, improving its suitability for juvenile fish passage. As juveniles arrive at the PSE diversion dam, they either enter the diversion flume or spill over the weir crest to the dam apron when streamflow is greater than the diversion flume's flow capacity. Juveniles traveling through the flume eventually encounter a relatively new Vee screen structure and fish bypass facility. Bypassed smolts reenter the White River in the bypass reach at RM 21.2.

Monitoring by PSE during the first three years of screen operation (R2 1998) concluded that the screen is successful at bypassing both yearling and young-of-the-year smolts, although recapture rates varied according to test group release site. It appears to function as intended, but there may be a loss of fish in the diversion flume and canal. Evaluation of the bypass screen effectiveness is compromised by the lack of monitoring and evaluation facilities in the screen design previously recommended by NOAA Fisheries. As a result, verification remains to be done. The plans for evaluation, operation, and maintenance contemplated by license article 409 present an opportunity to modify the screen bypass channel for the installation of a long-term monitoring and evaluation facility to verify that listed chinook salmon smolts are effectively bypassed and returned to the White River. However, no assurance of monitoring for effectiveness is provided in the license, so there is a continuing risk of an unacceptable level of take due to the bypass screen.

The bypass screen does not address fish losses in the flume, or power canal, between the point of diversion and the screen. Earlier studies by WDFW (Heg 1955, 1954, 1953) indicated a significant loss of juvenile salmon, including chinook, between the point of diversion and the old screens and bypass. The license includes no protection, mitigation, or enhancement measures to offset these unquantified losses.

2.1.2.1.3 Effects of Water Diversion

Effects of Water Diversion on Adult Upstream Passage, Adult Spawning Habitat, and Juvenile Habitat

Upon FERC approval of the stream flow monitoring plan required by article 406, license article 405 requires the following bypass reach continuous minimum flows, measured at the project diversion dam: January 265 cfs, February - July 180, August - September 350, October 400, and November - December 265 cfs (Table 1-2). FERC staff indicate these flows were developed to optimize habitat conditions for PS chinook salmon in the bypass reach of the White River and provide a significant enhancement to existing conditions. Staff concluded, therefore, that these flows would result in beneficial effects to listed chinook salmon. (Note: at the time of FERC's BA, the minimum instream flow was 130 cfs as measured at the boundary of the Muckleshoot Indian Reservation.) The prospective implementation date of FERC's approval of the stream flow monitoring plan contemplated by license articles 405 and 406 is unknown. The minimum instream flows described in Table 1-2 are likely to continue for an unknown time period.

PSE conducted an extensive instream flow analysis of the White River bypass reach during the period 1987 through 1993 using the Instream Flow Incremental Method (IFIM) (Bovee 1982). Much of the process was contentious. The study was scoped with agency and tribal input. Preference curves drawn from literature and the agencies were used. PSE later obtained some sight-specific juvenile chinook salmon and steelhead preference curves from fish observations in the White River during March and April of 1993 and 1994. Multiple transects were established in each of five study reaches for physical data collection. PSE's consultant developed the weighted useable area (WUA) curves from the data set and each of the parties interpreted the results. The monthly minimum instream flow recommendations for the bypass reach ranged from as low as 30 cfs to 500 cfs, with the lowest coming from Puget and the highest from the fisheries agencies (Table 2-3). FERC's flow schedule is a compromise, strengthened by its rationale that it provides about 97% of the WUA for juvenile chinook salmon rearing and nearly the same spawning WUA for adult chinook salmon and high WUAs for coho salmon, steelhead, and other species.

Note that the instream flow analysis estimates weighted usable area as habitat by species and life stage. The IFIM estimates do not consider water quality factors such as water temperature an pH, only area with respect to depth, velocity, substrate, and cover.

Table 2-3. The range in minimum instream flow recommendations for the White River bypassed reach, with a comparison to total natural stream flow.

Month	PSE	NOAA Fisheries & agencies	Mean river flow*	FERC proposed action	FERC mean diverted flow	FERC mean % flow diverted
January	130	350	1,600	265	1,335	83%
February	130	350	1,521	180	1,341	88%
March	130	350	1,308	180	1,128	86%
April	130	350/400	1,587	180	1,407	89%
May	130	350	2,127	180	1,947	91%
June	130	350	2,309	180	2,000	87%
July	130	350	1,484	180	1,304	88%
August	130	350	893	350	543	61%
September	130	350	673	350	323	48%
October	130	500	724	400	324	45%
November	130	425/350	1,393	265	1,128	81%
December	130	350	1,716	265	1,451	84%

*Mean monthly streamflow 1928-2000 USGS station 12098500 White River near Buckley, Washington.

NOAA Fisheries and the other resource agencies prepared their instream flow recommendations to FERC under Section 10(j) of the FPA to optimize anadromous fish habitat conditions for all species. PSE recommended the flows reached in a settlement agreement with the Muckleshoot Indian Tribe. FERC, as already indicated, attempted to optimize habitat conditions for chinook salmon and enhance existing conditions. Examining the IFIM results in isolation lends significant support to FERC's statement. NMFS (2002) reexamined the IFIM studies (PSP&LC 1987a, 1987b) and generally found that WUA was maximized for species and lifestages at this range of flows in Table 2-4, using the literature curves. The agency curves usually maximized WUA at slightly higher flows, but occasionally at lower flows.

Previous interpretations of the output weighted the five study reaches according to the length of the bypass reach they were believed to represent. NOAA Fisheries modified the weighting for juvenile chinook salmon to include only the upper two study reaches, based on new information that was not available at the time this IFIM study was performed. The Skagit System Cooperative (SSC 1998) found that juvenile chinook salmon habitat preference in the Skagit River is highly correlated with stream bank type over a range of river flows. Age 0+ chinook salmon utilized natural stream bank habitat approximately 3½ times more than modified bank habitat, with 82% of the variation explained by the presence of wood cover. The upper two White River study reaches are characterized by largely natural stream banks, and the lower three reaches are predominately modified by levees and rip-rap. Not surprisingly, surveyors now report that chinook salmon utilization appears to be greatest in the upper reaches. Consequently, the maximum WUA juvenile chinook salmon rearing flow, estimated from the IFIM study, is modified from the earlier analyses.

Table 2-4. Maximum weighted usable area v. discharge (Q) by species and life stage, based on re-weighting study reaches according to juvenile salmonid utilization.

Species	Q Spawning	Q Rearing
Chinook	415	150
Steelhead	500	260
Coho	315	150
Pink	550	
Chum	330	

A weakness in relying entirely on the IFIM results to establish instream flows ignores the environment that the White River fish population actually experiences. Bovee (1982) reminds IFIM users that more than micro-habitat analysis of instream flow is necessary to assess available and usable habitat. The bypass reach of the White River is occasionally a fully regulated river, often a partially regulated river, and sometimes even an unregulated river. The flow regulatory mechanisms are PSE's diversion dam, flowline, and the Corps' MMD, and natural streamflow. As a consequence, preferred fish habitat, particularly suitable juvenile rearing habitat, is quite literally a moving target between the low, regulated minimum instream flow of 130 cfs, intermediate flows, and much higher unregulated flows in excess of 1,000 cfs and up to 8,000 cfs. More important than maximizing WUA from a selected instream flow is the maintenance of habitat connectivity across the range of flows that the fish populations actually experience. As river flows increase, the main channel velocities increase, forcing many juvenile fish to seek refuge in protected side and back channels. This connectivity between the main channel and side channels is critical so that juvenile fish especially are not stranded in side channels and backwaters that become dewatered as streamflows recede from unregulated high flows back to the regulated minimum instream flow.

Spawning habitat is not limiting for chinook salmon or other species using the bypass reach, which could argue for lower spawning flows. However, if salmon and steelhead are constrained by too low spawning flows, they will spawn in or near the channel thalweg, that is, the deepest, highest velocity part of the channel, causing their redds, and the eggs therein, to be especially vulnerable to scour during the high flow events that occur every year.

The flow schedule listed by FERC is satisfactory for juvenile rearing and adult salmon and steelhead spawning, based on water volume for habitat. Our site survey of the braided channel study reach found approximately 85% percent of side and back channels connected sufficiently to permit juvenile passage among channels (NMFS 2002). This is not to say that the 350 cfs previously recommended under section 10(j) of the FPA is wrong or too much water, but rather that 180 cfs appears adequate to satisfy the critical need of connecting rearing habitat for juvenile chinook salmon. Surveyor observations and the IFIM results indicate that higher flows do not increase the wetted channel perimeter significantly until very high discharges are reached (PSP&L 1987). Depth increases somewhat, varying by site. Increased water velocity is the most noticeable change associated with increased discharge in the ranges observed.

FERC's flow of 180 cfs does not meet the biological requirements of adult chinook salmon in the months of May, June, and July for upstream migration. Average unregulated river flows during this time period range from 1,000 to more than 2,000 cfs. Chinook salmon must migrate through the White River to reach their spawning grounds at the right time and with adequate energy reserves to successfully reproduce. Adequate depth of water for migration is one factor affecting the proportion of the adult population succeeding in this migration. Bjornn and Reiser (1991) suggest that adult chinook salmon require 24 cm (0.8 foot) minimum water depth for migration. As Thompson in Bjornn and Reiser (1991) describes the depth criteria, "For each transect, the flow is selected that meets the criteria on at least 25% of the total transect width and a continuous portion equaling at least 10% of its total width." The control points for meeting this stream migration depth occur at several steep gradient diagonal riffles of the main, not side, channel we observed in the bypass reach. Even a flow of 460 cfs does not satisfy the 10% and 25% criteria (NMFS 2002). If this depth issue were chronic throughout the bypass reach, Thompson's criteria would specify a minimum flow in excess of 500 cfs for adult migration. However, the depth problem occurs at locations few in number and very short in observed length. We measured depths across one or more of these transects at flows ranging from 130 cfs to 460 cfs and found that 265 cfs provides 0.8 foot of depth across six or more continuous feet of the transect, but 180 cfs does not (NMFS 2002). The Muckleshoot Indian Tribe measured physical habitat at three sites on the White River (unpublished data 2002). They modeled depth versus flow relationships in riffle areas. Riffles oriented perpendicular to the longitudinal axis of the river channel meet the migration depth criterion at lower flows than the diagonal riffle in their sample. The diagonal riffle in the Muckleshoot sample meets the migration depth criteria at a flow of 265 cfs, also. Based on the known occurrence of several such riffle locations, the minimum instream flow of

180 cfs ordered by FERC in the project license fails to provide adequate depth for adult chinook salmon upstream migration during the months of May, June, and July.

Effects of Water Diversion on Altered Flow Patterns

The continuing downstream migration is dependent, in part, on the minimum instream flow of the bypass reach. The baseline flow of 130 cfs is more conducive to survival than the previous minimum of 30 cfs. The prospective bypass flow of 180 cfs is a further improvement, although migrating chinook salmon would likely benefit from even higher flows that would better facilitate predator avoidance and higher water velocities.

FERC's instream flow of 180 cfs from February through July maintains a static rearing environment through the winter and early spring for migrating juvenile chinook salmon. Increases in river discharge stimulate the movement of salmon and steelhead smolts. Chinook salmon smolt to adult survival is generally positively correlated with streamflow during the outmigration period (Wetherall 1971). May is the peak month for chinook salmon emigration and it is usually over by the end of June (see section 2.1.1.3). Continuing the low winter instream flow through the peak period of outmigration does nothing to enhance smolt outmigration. As a general practice, NOAA Fisheries recommends or requires increases in spring flows to aid juvenile outmigrations. Higher flows in May and June would also benefit other species emigrating then. A minimum instream flow of 265 cfs during May and June, which NOAA Fisheries determines is necessary to meet adult passage requirements, would also provide a significant juvenile salmon benefit in addition to satisfying adult migration requirements.

Effects of Downramping

PSE can start or shut down the project in a manner that causes the water surface elevation to change rapidly. This can occur in both the bypass reach from operation of the diversion dam and the lower White River downstream of the confluence of the bypass reach and the tailrace. Rapid upramping is not known to generally cause direct harm to fish, as water depths and velocities increase. Rapid downramping, which dewaters fish habitat, has been shown to strand juvenile salmon and steelhead, causing direct and delayed mortality (Hunter 1992). The proposed action requires a ramping rate monitoring plan in license article 406. Article 403 requires operation of the project with interim ramping rates, downstream of both the diversion dam and the project tailrace, equivalent to the Washington State guidelines described by Hunter (1992). The license anticipates at article 404 a future alternative ramping rate schedule based on a site-specific study plan.

Fish kills associated with diverting water from the bypass reach to the diversion flume occur with enough frequency to be described as chronic. A major kill occurred in September 2000 and another in April 2003. Informal reports of lesser losses and lacking documentation have occurred in every recent year.

Based on numerous downramping studies cited by Hunter (1992), project downramping will cause direct mortality and take of listed chinook salmon. However, the Washington State ramping guidelines described in article 403 and Table 1-1 meet the biological needs of chinook salmon by avoiding and minimizing the most deleterious effects of project downramping. Article 406 creates some uncertainty as to what future downramping requirement will be. The Washington State ramping rate guidelines described by Hunter (1992) do not eliminate juvenile salmon and steelhead mortality due to stranding. The guideline rates do minimize gravel bar stranding, but stranding in potholes remains as a potential project effect that causes direct mortality.

The fish kill in April 2003 provides a strong indication that the Washington State downramping guidelines alone are not enough to provide the level of protection necessary for survival and recovery of the species. The critical flow, the flow at which downramping rate restrictions are imposed is critical to minimizing fish losses due to downramps. A critical flow of 1,000 cfs has been used for the White River bypass reach. However, the fish kill of April 2003 indicates that many of the mortalities were in side channels that were dewatered between the beginning flow of 1,600 cfs and 1,000 cfs. By definition, if generally utilized habitat occurs at flows above 1,000 cfs, then the critical flow is greater than 1,000 cfs.

Additionally, flow amplitude is an important parameter affecting stranding losses during downramps. The April 2003 event was a flow change from 1,600 cfs to 200 cfs, representing an eight-fold change in water volume. Proportional changes need to be much less to significantly reduce fish losses. Amplitude changes on the order of a 50%, or less, decrease per day in flow are associated with high fish survival on the Skagit River (Beck Associates 1989; Pflug 2000, pers. comm.).

NOAA Fisheries' conclusion that, in spite of some mortality the Washington State downramping rates, along with a suitable critical flow and amplitude, will meet biological requirements, is based on studies in this area. PSE performed a site-specific downramping study on the lower White River, downstream of the project tailrace, in 1998 (Beak, R2 1998). The study indicates that chinook salmon fry that are of the size range vulnerable to stranding are present in the study area during the late winter and spring. The study also notes that due to channelization from levees and rip-rap, there are only a few sites in the lower 3.6 miles of the White River and lower Puyallup River where fry stranding is likely. Downramping was not studied in the project bypass reach downstream of the diversion dam.

Subsequent effort by PSE extended the stranding study into the Puyallup River, to which the White River is tributary. The additional flow provided by the Puyallup significantly attenuates the vertical stage change associated with downramping events, and downramps are greatly attenuated by the Puyallup River when its discharge is greater than 2500 cfs. The interim downramping rates described by Hunter (1992) are appropriately applied to both the bypass reach downstream of the diversion dam and the tailrace at Dieringer powerhouse. The completion of site-specific investigations on downramping may indicate that the tailrace downramping standard can safely be moved downstream to the lower Puyallup River stream gage when the Puyallup is less than its critical flow of 2500 cfs. The site-specific investigation needs to correlate and translate what the state guidelines would then look like in the White River tailrace, where that gage could be used for downramping compliance monitoring.

The outcome of article 404 is unknown and may include future downramping rates that exceed the Washington guidelines and increase mortality above that which will occur under those guidelines. NOAA Fisheries cannot know what final downramping schedule might be approved by FERC, so the direct effects of prospective project downramping are unknown.

Article 406 requires a plan to install, operate, and maintain staff gages to monitor ramping rates and minimum instream flows. There exists a risk that ramping rates and minimum instream flows will not be successfully or accurately monitored.

Effects of Water Diversion on Water Quality

Acidity/Alkalinity (pH)
The White River receives three treated sewage inputs, one just upstream of the project diversion dam and two a short distance below it, as well as numerous non-point sources. The effect of this nutrient enrichment is an elevated concentration of soluble reactive phosphorus that leads to significant attached algal growth in the bypass reach, which leads in turn to significant diurnal increases in pH (i.e., high alkalinity).

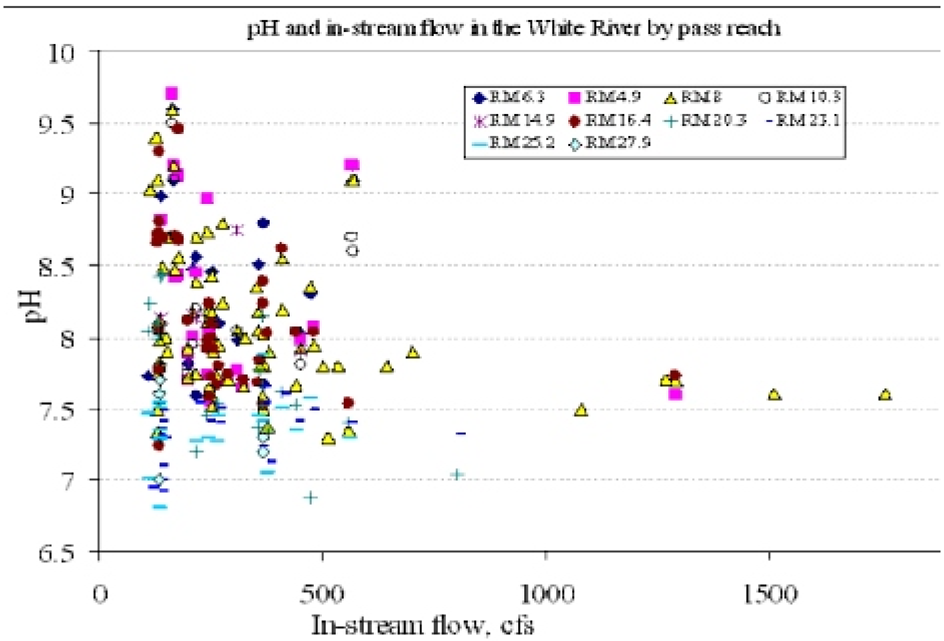


Figure 2-2. pH and White River bypass reach instream flow.

Figure 2-2 is a plot of pH observations at various streamflows measured downstream of the diversion dam from 1990 to 2001. A value of 7 is neutral, and numerous recordings above the Washington State water quality limit of pH 8.5 are noted. Bell (1986) indicates a maximum pH of 8.3 as suitable for chinook salmon. The issue is important relative to chinook because of salmonid tolerance of high pH, but also because ammonia concentrations in the water become increasingly toxic to salmon at higher pH values. Figure 2-3 describes the frequency of pH excursions greater than 8.5 relative to streamflow, with most excursions occurring at flows less than 250 cfs.

There are also examples of excursions at higher flows, and PSE (Barnes 2002, pers. comm.) suggests that the limited evidence at hand suggests the contrary case of increasing flows correlating to increased pH is just as likely. Brett (2002) and Stuart (2002) directly examined the effects of streamflow and other factors on pH fluctuations in the White River. Scientific evidence does point to this relationship. NOAA Fisheries agrees with the WDOE water quality specialist that the preponderance of data indicate that increasing stream discharges improves water quality, particularly pH (Erickson 2002, pers. comm.). Therefore, while pH excursions would not be completely eliminated, the data suggest that the frequency of occurrence of excursions will be significantly reduced when stream discharge is 250 cfs or greater. Given the need for 265 cfs in May, June, and July for adequate stream depth during adult migrations, a minimum flow of 250 cfs during February, March, and April should significantly reduce the frequency of pH excursions that may adversely affect listed chinook salmon. In the event that new data or actions to improve water quality are implemented such that the flows in the bypassed reach may be further reduced, FERC could reinitiate Section 7 consultation based on that information and possibly amend the instream flow schedule during this time period to satisfy chinook salmon habitat requirements both in terms of flow volume and water quality. Meanwhile, the FERC-ordered minimum instream flow of 180 cfs during the months February through July, which is higher than recent baseline minimum flows, still impose an avoidable risk of exposure to pH excursions known to be deleterious to listed chinook salmon. PSE/LTTF in their comments stress that the project is not the source of the pollution. That is correct; upstream point and non-point sources are. However, the proposed project action of diverting water to generate energy results in increased concentrations of pollution added just downstream of the diversion dam by the Enumclaw and Buckley sewage treatment plant discharges. Absent the proposed action of diverting water for energy generation, instream flows would be higher in the White River bypass reach, and pollutants would be significantly less concentrated. To the extent that increased instream flows contribute to the avoidance or reduction of pH excursions, that project effect would be avoided or reduced.

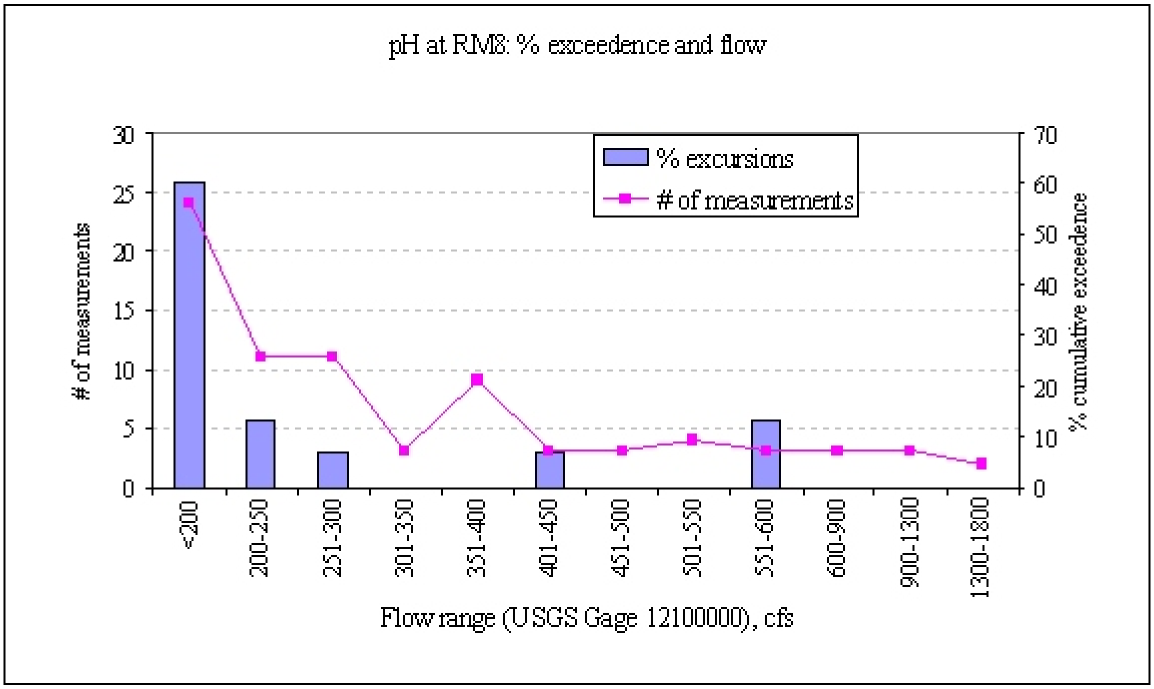


Figure 2-3. Frequency of excursions above pH 8.5 v. stream discharge.

PSE disagrees with NOAA Fisheries' legal basis for RPA element 4, which addresses the issue of pH excursions in the bypass reach. They further comment that there is uncertainty that RPA element 4 will effectively reduce pH excursions. Much of science does not provide absolute certainty, with regard to pH or other factors affecting listed chinook salmon. The ESA directs NOAA Fisheries to treat uncertainty with deference to the listed species.

The White River downstream of MMD exceeds DOE standards for fecal coliform pH, temperature, instream flows, copper and mercury (both associated with Buckley Sewage outfall; WDOE 1998). Most of the exceedences were observed within the bypassed reach. The elevated pH (alkaline condition), up to 9.5, observed in the bypassed reach is likely caused by the photosynthetic activity of algae. Inputs of phosphorus and nitrate from the sewage treatment plants and other sources when combined with reduced stream flows associated with low flows, stimulate algal growth, resulting in high levels of photosynthesis on sunny days when the water is clear. The photosyntheic activity depletes the water of inorganic carbon (mostly CO2) which results in an increase in pH . The daily pH fluctuations in this reach also exceeded the WDOE standard of 0.5 pH units per day. The pH fluctuations show a diurnal pattern with high pH associated with daylight hours, dropping to normal levels, pH 7-7.5, during the night.

Turbidity and flows appear to be important physical factors affecting the pH fluctuations and peak pH. The White River has a strong annual cycle in water clarity associated with the input of fine sediments during periods of glacial melt. When the glaciers are melting there are high levels of fine sediment suspended in the water, preventing sunlight from reaching the algae on the stream bottom. This limits photosynthetic activity, so inorganic carbon is not depleted from the water column and pH is not elevated above normal levels. Investigation conducted by the University of Washington (Brett 2002; Stuart 2002), when total suspended solids (TSS) exceeded 200 mg/l, representing high levels of sediment in the water and thus turbid conditions, pH peaks exceeding 8.5 were rare (0 of 34 observations). When TSS was low (<10 mg/l), pH peaks commonly exceeded 8.5 (14 of 19 observations). At a study site above the sewage treatment inputs (RM 27.9), during low TSS levels no pH peaks (0 of 8 observations) exceeding 8.5 were observed and the mean diurnal pH fluctuation was 0.09 pH units. This observation indicates that nutrient input, and the resulting increase algal growth and photosynthetic activity, are the source of the high pH observed in the bypassed reach.

Temperature

Chinook salmon survive across a significant water temperature range. However, Bell (1991) indicates 13.3°C as the upper optimum for all races, suggesting an upper temperature limit of 13.3°C for migrating spring chinook salmon, 20°C for summers, and 19.4°C for fall chinook salmon. The project affects White River water temperatures in two ways. Water warms in the downstream direction during the warmer months of the year, unless specific cool water inputs are added. When the White River project diverts water into the power canal, it reduces the available water flow in the bypass reach. The reduced flow then absorbs more ambient heat than would be the case if the full flow of the river remained in the bypass reach (Sinokrot and Gulliver 2000).

Lake Tapps is the 2,700 acre storage reservoir for the project, and discharges from the powerhouse include water temperatures that range as high as 18°C (HDR 2001).

Hallock et al. (1970) indicated that chinook salmon migration can be delayed when natal stream temperatures are too warm. Elevated temperature can delay migration, reduce maximum available dissolved oxygen, lead to disease outbreaks, and accelerate or retard sexual maturation (Spence et al. 1996; Byornn and Reiser 1991). McCullough (1999) summarizes several chinook salmon life history stage temperature requirements and optima. He describes 21.0°C as a thermal blockage and near the adult incipient lethal temperature. Adult female holding temperatures should be less than 16.0°C for maximum egg viability, and 15.5°C or less to minimize incidence of disease and pre-spawning mortality rates (McCullough 1999). Berman (1990) observed that reproductively mature spring chinook salmon held at temperatures between 17.5 and 19°C had more pre-hatch mortalities and developmental abnormalities, as well as smaller eggs and alevins, than adults held at temperatures between 14.0 and 15.5°C.

The Washington State water temperature standard is 18°C for freshwater Class A streams. Although this standard is intended to protect fish life, it is less protective in general, and certainly less so for the specific critical life stages mentioned above of female holding prior to spawning, spawning, and egg incubation. The state standards are presently being reviewed for possible revision.

The EPA (2002) describes recommended maximum temperatures in its Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. Tables 3 and 4 use the 7DADM standard, which is the maximum 7-day average of the daily maximums. Table 3 describes 16°C as the 7DADM for core salmon and trout juvenile rearing, which in river basins of the west slope of the Cascade Mountains, may apply all the way to the saltwater estuary. For juvenile rearing in non-core areas and for adult migration, 18°C is the 7DADM. Table 4 describes 13°C as the 7DADM for egg incubation and fry emergence.

NOAA Fisheries seeks to ensure that project operations: 1) avoid creating lethal water temperatures, 2) not create water temperatures avoided by migrating, holding, spawning, or rearing chinook salmon, and 3) minimize water temperature effects so as to reduce the occurrence of lethal and sub-lethal temperature effects. During the summer months, project operations increase the bypass reach water temperature by an average of 2°C according to the data referenced below. That increases to 4° or 5° during the warmest periods. Sub-lethal effects are expected to occur, including increased occurrence of fish diseases, with or without the project exacerbating temperatures; however, the extent of those effects cannot be quantified.

Temperatures in the months October through May are not likely to be a problem. Chinook salmon egg incubation is most successful at 13.3° and lower. Leitritz (1980) noted that chinook salmon eggs will not develop normally under constant water temperatures above 13.3° C (56°F). Such temperatures generally prevail from October through May.

White River water temperature data have been collected by PSE, DOE, the Puyallup Indian Tribe, and others. In the summer of 2001, a peak water temperature of 16.88°C upstream of the project diversion was observed while a high of 22.57°C was recorded at RM 4.9, near the lower end of the bypass reach. The high temperature recordings occurred at stations maintained by the Puyallup Indian Tribe. PSE recorded significantly lower temperatures on the same dates at a station at RM 4.0. Although there are discrepancies, the data indicate that White River temperatures frequently are above the preferred and recommended ranges for chinook salmon. Ambient water temperatures above the preferred range can be expected at the project diversion dam by early July and may continue through September. Water diversions during warm weather in these months are expected to exacerbate heating through the project bypass reach as suggested in Platte River work by Sinokrot and Gulliver (2000).

Elevated temperatures have been observed in the bypassed reach July through September. No data is available for June temperatures, but high water temperatures observed in early July suggest the possibility of elevated temperatures in June as well. The bypassed reach of the White River appears on the 1998 WDOE list for high water temperature (303(d) list). Continuous measurements were collected in 2001 by WDOE, the Puyallup Indian Tribe, the University of Washington, and PSE in the White River bypass reach. Temperatures exceeded 18ºC throughout the monitoring period and at all monitoring locations within the bypass reach (RM 16.4, RM 8, and RM 4.9). All peak temperatures measured in the bypass reach were higher than background temperatures measured at RM 38.

Temperature observations in 2001 start on July 3 (Figure 2-4). Temperatures exceeding 18°C were observed at RM 8 and RM 16.4 on that date. The presence of elevated temperatures at the beginning of monitoring strongly suggests that high temperatures may also occur in June. Peak temperatures reached 22.6°C at RM 4.9, 21.8°C at RM 8, and 19.7°C at RM 16.4. During the period July 3, 2001, through September 26, 2001, maximum daily temperature exceeded 18°C on 55 days of the 90-day monitoring period. At RM 4.9, there were 52 periods observed when water temperatures exceeded 18°C from the start of monitoring on July 8, 2001, through September 8, 2001. The length of the exceedence periods ranged from 1-15 hours with a mean time of 6.4, $\pm$ 4.2 hours (Figure 2-5). This indicates that water temperatures in the bypass reach frequently exceeded 18°C and remained above that temperature for relatively long periods of time. The overall pattern appears to be one of periods of greater than 18°C beginning in June (no data) or July. The exceedences are frequent and of relatively long duration. After mid-August, the exceedence periods were less frequent and of shorter duration. Temperatures greater than 18°C were not observed after September 16, 2001.

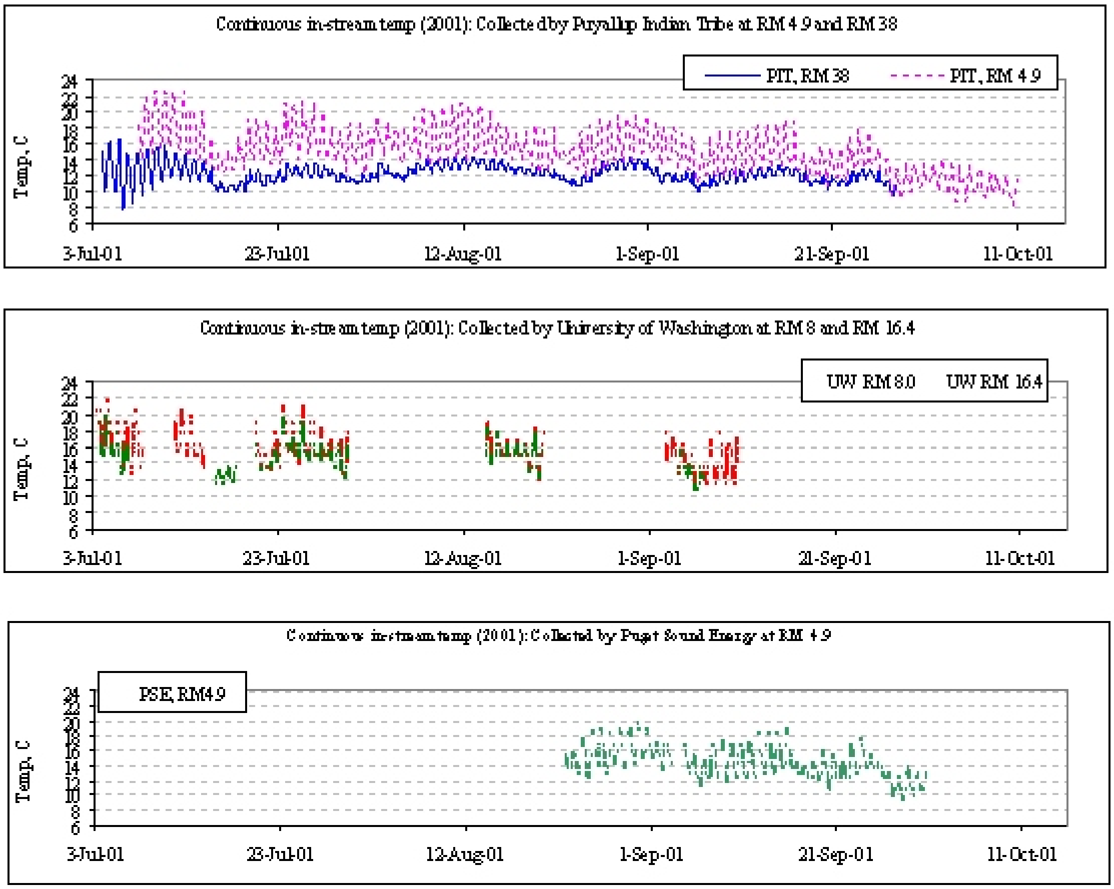


Figure 2-4. Continuous instream temperatures collected in 2001 in the vicinity of the White River project.

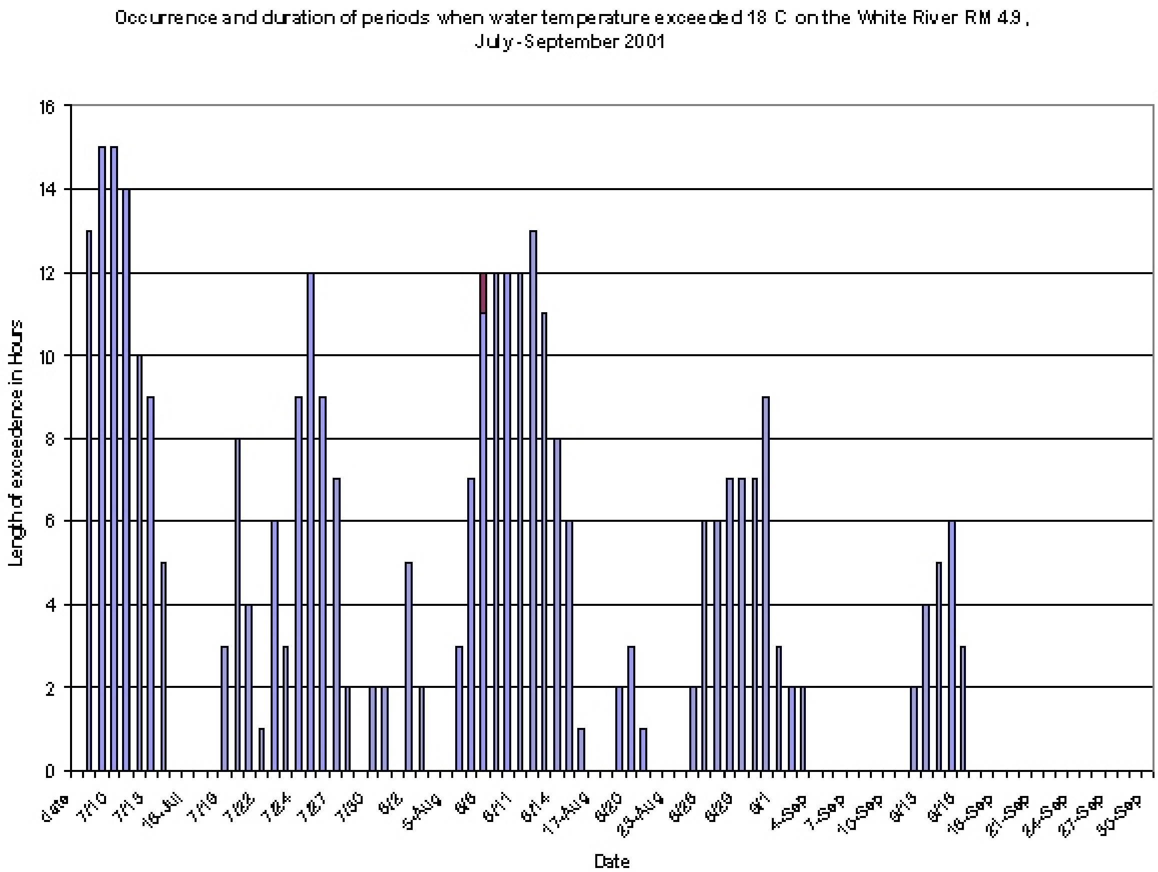


Figure 2-5. Occurrence and duration of periods when water temperature exceeded 18°C on the White River at RM 4.9, July-September 2001.

White River flows ranged between 238 and 368 cfs during the monitoring period. Even in this narrow range of flows, the highest temperatures were observed at lower flows. For example, at RM 4.9, peak temperatures in excess of 22ºC were observed at lower flows (~260 cfs) compared to peak temperatures of about 21ºC at a higher flows of about 360 cfs. Similarly, for RM 16.4 and 8, higher peak temperatures were observed at lower flows.

More water in the bypass reach would lead to lower temperatures from the greater heat capacity of increased volume, increased depth, and a shorter retention time in the bypass reach from increased velocity. During the months in which critical temperatures are exceeded, the proposed action diverts into Lake Tapps an average of 48% (September) to 92% (June) (Table 2-3) of the water that would otherwise flow through the White River bypass reach. Potentially, on average, the river flow in the bypass reach could be nearly doubled in late summer and increased nearly 10-fold in the early summer, compared to FERC's proposed flows, to reduce temperatures that result in harm to listed chinook salmon. Figure 2-6 indicates that additional water is available. The figure is a plot of daily peak temperatures in excess of 18ºC (at RM 4.9) and flow diverted to Lake Tapps, which could otherwise be routed through the bypass reach. Flows in excess of 500 cfs are generally diverted to Lake Tapps during periods of peak temperatures exceeding 18ºC. The low flows (less than 50 cfs) shown in the graph are from August 2001, when no flow was being diverted to Lake Tapps. This does not mean that flow was not available for diversion to the Lake. Flow was available, but was being held at the MMD due to maintenance work conducted by PSE on its flume. Taking out the misleading August "low" flows, the available (or diverted) flow during periods of high temperature (greater than 18ºC) is then always in excess of 300 cfs, and greater than 400 cfs 85% of the time, greater than 500 cfs 76% of the time, and greater than 1000 cfs 23% of the time. In summary, water is available above the diversion that could be used to reduce the temperature increase in the bypass reach.

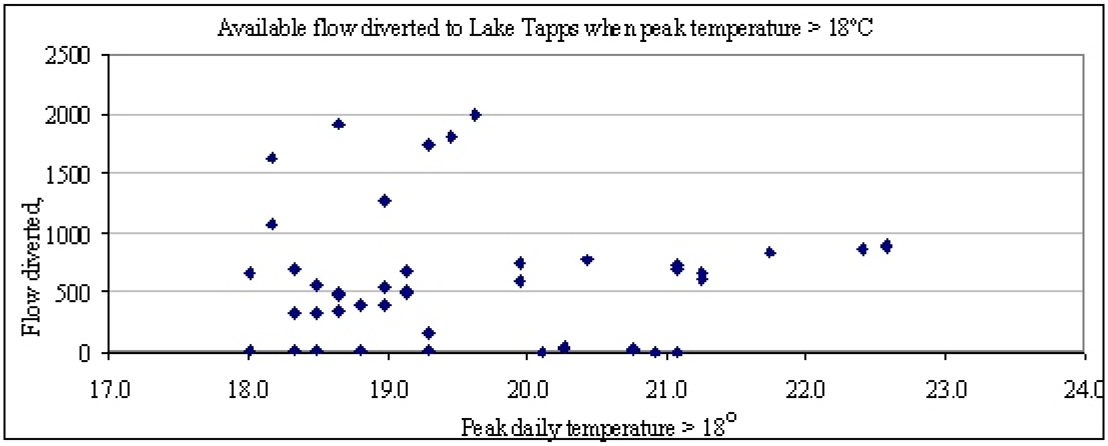


Figure 2-6. Available flow diverted to Lake Tapps when temperatures were greater than 18ºC in 2001.

The minor water diversion and use allowed by article 419 would exacerbate other flow limiting effects, but the specific effect of that diversion and use would be very small.

In response to discussions between PSE and NOAA Fisheries prior to the October 2002 release of the preliminary draft of this Opinion, PSE/LTTF hired R2 Resource Consultants, Inc. R2 assessed the effects of the White River Hydroelectric Project on water temperatures relative to chinook salmon requirements and presented an independent temperature standard and recommended response to elevated temperatures. R2's work cited many of the same temperature references that we do in this section. R2's assessment is that 13.3°C is not supported by solid scientific information for this Opinion. Leitritz' (1980) observation that chinook salmon eggs do not develop normally when exposed to constant temperatures above 13.3° is the best available scientific information we found regarding chinook salmon egg incubation temperature requirements.

R2 recommends that adult migration and holding temperature not exceed 21°C for more than 3-4 hours during any portion of the day during the migration period from May to October. Exceedences longer than this could delay upstream migration and increase stress and disease susceptability. Berman (1990) found the latter two of those three effects - stress and disease in the form of pre-spawning mortality - at holding temperatures of 17.5 to 19°C. She additionally observed increased pre-hatch mortalities, developmental abnormalities, and smaller eggs and alevins. NOAA Fisheries finds that the best available science supports adult holding temperatures lower than 17.5 to 19°, and less than 21°C, as reasonable for the survival and recovery of WR chinook salmon. The EPA guidance for temperature standards analyzed all the scientific references cited here, and more, in developing the regional recommended temperature standards.

NOAA Fisheries reviewed scientific information and derived a range of temperatures to describe the biological requirements of chinook salmon. PSE and R2 suggested an alternative, which we rejected after considering their arguments and re-reviewing the relevant scientific information.

Summary of Effects of Water Diversion

Table 2-5. Summary of effects of water diversion.

Month	**Flow (cfs) to meet Biological Requirements**	**FERC Flow (cfs)**	**Comment**
Nov. - Jan.	265 Incubation, winter rearing.	265	Meets biological requirements.
Feb. - Apr.	250 pH $\leq$8.5 @ flows < 250 cfs, incubation, juv. rearing.	180	Does not meet biological requirements.
May - July	265 Adult migration: 24 cm min. depth; juv. migration: some flow events >180 cfs ; juv. rearing; pH $\leq$8.5 @ flows < 250 cfs. *	180	Does not meet biological requirements.
Aug. - Sept.	350 Adult migration, spawning, incubation, juv. rearing. *	350	Does not meet biological requirements.
October	400 Adult migration, spawning, incubation, juv. rearing.	400	Meets biological requirements.

* Flow volume for habitat is met, but flow for water quality parameters like temperature may not be met. See temperature effects discussion.

2.1.2.1.4 Effects of Tailrace Barrier and Tailrace Operations

Effects of Tailrace Flow and Tailrace Barrier

Adult chinook salmon migration is impeded by current tailrace conditions. Water volume in the lower White River downstream of the tailrace may be identical to the bypass reach when the bypass flow is the only flow reaching the lower White River, or it may be an order of magnitude higher when the Dieringer power plant is running near its capacity. Radio-tagging studies by the Puyallup Indian Tribe (Ladley 1999) indicate that adult chinook salmon are attracted by and into the project tailrace and also delay there, in one instance for more than 40 days. The tailrace barrier described by license article 408, along with increased minimum instream flow, is expected to eliminate entry into the talrace, and it may reduce migration delay by directing migrating fish to the bypass reach river channel. However, the tailrace barrier alone may not be sufficient to cause adult chinook salmon to proceed with their upstream migration in the bypass reach, particularly when tailrace discharges greatly exceed bypass reach flows.

Construction of the tailrace barrier may adversely affect chinook salmon by trapping them or causing direct physical damage. Coordination of construction timing and methods could avoid or reduce this likelihood.

Effects of Tailrace Water Quality

Dissolved Oxygen

Dissolved oxygen (DO) in the tailrace is also affected by the project. The tailrace discharges water from the Lake Tapps storage reservoir. Lake Tapps is a mostly shallow water body, so much of the water volume is subject to heat accumulation during the summer months. Water temperature and DO are inversely correlated. The Washington State water quality standard for DO is 8 mg/l. Swimming performance declines for juvenile salmon when DO is less than 7 mg/l (Davis et al. 1963). Wedemeyer (1974) reviewed the role of stress as a predisposing factor in fish diseases and concluded that DO should be 6.9 mg/l, or higher, to optimize fish health. Tailrace DO concentration values below 7 mg/l have been recorded. Factors other than the White River hydro project contribute to DO depression, so the state standard of 8 mg/l leaves some room for additional downstream effects.

Temperature

Tailrace discharge temperatures are usually cooler than the water it joins from the bypass reach, but they range upward to 18°C during the summer and fall months. The effects on chinook salmon are discussed in the above section on water diversion effects on water temperature. Chinook salmon are known to enter the project tailrace and may be subject to the occasional adverse sub-lethal effects of warm temperatures. Subordinating tailrace discharge during the summer and fall months to the bypass reach water temperature at the confluence with the tailrace would prevent project-induced exacerbation of effects.

2.1.2.1.5 Other License Measures

Article 407 requires the implementation of the Lake Tapps Fisheries Enhancement Plan mentioned in the project description. The plan includes the stocking of kokanee salmon fry and rainbow trout. Some of these fish could escape from the lake, but only through the powerhouse penstocks and turbines, and with a significant turbine mortality. Any effect accruing to downstream fishery resources would be minimal. Upstream escape from Lake Tapps is precluded by barriers, including the fish screen that diverts downstream migrating fish from the flowline back to the White River bypass reach. A new powerhouse is planned to take advantage of hydraulic head in the flowline. This would also serve to limit the upstream escape of fish from Lake Tapps. Other license articles are not expected to affect listed chinook salmon.

2.1.2.1.6 Summary of Project Effects

Table 2-2, the Matrix of Pathways and Indicators (MPI) summarizes the baseline condition of salient habitat parameters that affect chinook salmon. The following table (Table 2-6) summarizes project effects on listed chinook salmon or their habitat relative to the baseline conditions. Recall that in the MPI, because of the strong causal link between habitat and fish population response, measured changes in habitat are often a proxy for the species itself. We indicate the effect trajectory of specific license actions. Specific license actions may improve, reduce, or have no affect on the trajectory toward PFC of one or more habitat elements. Actions may have similar effects on chinook salmon directly.

Table 2-6. Summary of effects of proposed action. IMPAIR = impair properly functioning habitat; REDUCE = appreciably reduce the functioning of already impaired habitat; RETARD = retard the long-term progress of impaired habitat towards properly functioning condition; NR = not reduce, retard, or impair; NPF = baseline not properly functioning; AR = baseline at risk.

Proposed Action or Structure	**Project Effects**	**Habitat Matrix Effects**		**Baseline Function**	**Effect of Action**	**Result**
		Habitat	**Salmonid life stage**			
Diversion Dam	Dilapidated structure may injure fish	Access-Barrier	Adult upstream migrants, fallbacks	NPF	REDUCE	
	Dam may fail, making fish hauling operations impossible	Access-Barrier	Adult upstream migrants	NPF	REDUCE	
	Dam blocks access to river reach between diversion dam and Mud Mountain Dam	Access-Barrier	Adult upstream migrants	NPF	REDUCE	Some access to fish falling back through Mud Mountain Dam
	Blocks LWD transport	Habitat Elements-Large woody debris	All life stages	NPF	RETARD	
Intake canal	Entrains juveniles and adult fallbacks possibly causing injury, mortality or delay	Access	Juvenile downstream migrants Adult upstream Migrants	NPF	RETARD	New Fish Screens built, but efficacy is unknown.
	Traps and removes sediment from River	Habitat elements, substrate	All life stages present	NPF	RETARD	Impacts habitat formation downstream to estuary
Water Diversion	Greatly reduced flows to 21 mile reach of river result in insufficient depth for adult passage	Access-Barrier	Adult upstream migrants	NPF	REDUCE	Proposed license with increased flows but not sufficient to meet passage requirements

Proposed Action or Structure	**Project Effects**	**Habitat Matrix Effects**		**Baseline Function**	**Effect of Action**	**Result**
		Habitat	**Salmonid life stage**			
Water Diversion	Low water volume in bypassed reach recieves effluent from sewage treatment plants, leading to eutrophication and high pH events	Water quality-Contaminants	All life stages present.	NPF	REDUCE	Proposed license with increased flows but not sufficient to reduce the effects of pH events
	Low water volume in bypassed reach contributes to increased summer water temperatures	Water quality-Temperature	Adult upstream migrants, juvenile rearing	NPF	REDUCE	Proposed license with increased flows but not sufficient to reduce temperature increase
	Flow regulation impedes habitat formation process in bypass reach, sediment and LWD transport	Channel dynamics, Channel morphology, Habitat elements	All life stages present	NPF	RETARD	
	Reduced flows reduce amount of available habitat	Habitat elements	Juvenile rearing, Adult upstream migrants, spawning	NPF	NR	Increased flows in proposed license adequate for spawning and rearing habitat connectivity, etc.
	Uncontrolled ramping leads to stranding	Altered flows	All life stages present	NPF	Interim RRs =NR; Future RRs = REDUCE	Interim implementation of WA State ramping rates meets biological requirements; Future ramping rates undefined, but may provide less protection

Proposed Action or Structure	**Project Effects**	**Habitat Matrix Effects**		**Baseline Function**	**Effect of Action**	**Result**
		Habitat	**Salmonid life stage**			
	Altered patterns of flow slow down downstream migration	Altered flows	Juvenile downstream migrants	NPF	REDUCE	
Tailrace	strong flows attract adult upstream migrants	Altered flows, Barrier	Adult upstream migrants	NPF	NR	Proposed tailrace barrier will prevent access to turbines, but there may still be some delay
	Uncontrolled ramping leads to stranding	Altered flows	All life stages present	NPF	Interim RRs =NR; Future RRs = REDUCE	Interim implementation of WA State ramping rates meets biological requirements; Future ramping rates undefined, but may provide less protection
	Discharge of water of degraded quality from Lake Tapps/ Power House, Low D.O., Temperature, Gas supersaturation	Water Quality	All life stages present	NPF	REDUCE	Causes low DO in downstream reaches, impacts reserve capacity of Puyallup River
	Large daily variations in water release have unknown effect on downstream reaches and estuary	Water Quality, Habitat elements	All life stages present	AR	REDUCE	

Proposed Action or Structure	Project Effects	Habitat Matrix Effects		Baseline Function	Effect of Action	Result
		Habitat	Salmonid life stage			
Construction of Tailrace barrier	Possible construction effects, block fish access to tailrace (benificial)	Potential for Water Quality, Habitat Elements	Adult upstream migrants, juvenile migrants	NPF	REDUCE	Construction guidelines are too general to evaluate construction effects.
New powerhouse construction; possible const. of other structures	Powerhouse - Downstream of fish screens on intake canal, no likely effect on fish; Other Structure - unknown effects.	Potential for Water Quality, Habitat Elements	No life stages present for new powerhouse; other structures may affect juveniles or adults	NPF	RETARD	Although impacts from powerhouse construction are minimal, construction guidelines are too general to evaluate construction effects on all potential construction projects.
Lake Tapps Fisheries enhancement plan	Fish stocked in Lake Tapps may escape and compete with native fish		Juvenile rearing		RETARD	

2.1.2.2 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." This is step 4 in NOAA Fisheries' analysis process. Other activities within the watershed have the potential to impact fish and habitat within the action area. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being reviewed through separate Section 7 consultation processes. Past Federal actions have already been added to the environmental baseline in the action area.

What is probably the most important cumulative effect over the term of this Opinion is the continued residential, urban, and industrial development of the White River Watershed. Over the last 10 years, the Puget Sound lowlands have displayed a pattern of rapid urban expansion. The relatively short distance from the White River Watershed to the major urban centers of Seattle and Tacoma almost guarantee continued development in the area. The Puget Sound Regional Council predicts that between 1998 and 2030 there will be a 37% increase in population in the lower White River Watershed (excluding Tacoma) increasing from 210,000 in 1998 to 330,000 in 2030 (PSRC 2001). Even if the recent accelerated rates of urban expansion slow, over the 50-year term of the license there is certain to be increased development of the White River Watershed.

Expected effects of development include those that directly affect the White River itself and those that affect the watershed. Changes to the river and the watershed effect the capacity of the White River to fulfill the biological requirements of WR chinook salmon. The White River currently receives sewage treatment effluent from the cities of Enumclaw, Buckley, and Sumner. The Buckley and Enumclaw treatment plants discharge directly into the bypassed reach. The predicted population increase in these cities of 20% between 1998 and 2030 (PSRC 2001) will cause increased load on the sewage plants. The reduced flows of the bypassed reach are unlikely to absorb this increased load without catastrophic degradation of water quality.

In addition to (and seemingly contrary to) increased demand for water to dilute and carry away wastes is increased demand for water for consumption. Modifications to the watershed associated with development including paving, increased drainage network, loss of forest and riparian vegetation, and road building are associated with increased non-point source pollution, sedimentation, increased water temperatures, and reduced flows. The likely effects of continuing development of the watershed are degraded water quality, increased water temperatures, and reduced flows.

With the large amount of land owned by the Weyerhauser Corporation in the upper watershed, continued logging over the course of the license is almost certain. However, further logging will be done under the Washington Forest Practices Act, which contains a number of measures, including riparian buffer zones, to reduce the negative effect of logging on streams. If these practices are followed, while there will still be negative effects, they should not be of the magnitude associated with logging in the watershed over the last 60 years. There are also efforts, at least on USFS lands, to rehabilitate degraded habitat and address problems such as impassible culverts. Over the course of the license there are likely to be continuing effects on WR chinook salmon productivity from logging operations in the upper watershed. However, if stream protecting forest practices are followed, these impacts should be reduced. This, combined with habitat restoration efforts, may lead to an improvement in habitat over recent conditions, although recovery to pre-1940 conditions seems unlikely.

The Tacoma Water Supply currently plans to replace the waterline crossing at RM 24 with a buried pipe, eliminating the present concrete structure covering the pipeline crossing. Since the concrete structure has presented a significant barrier to upstream migration and has been associated with dewatering mortalities, its elimination should improve the success of migrating WR chinook salmon passing through the bypassed reach. Replacement of the waterline crossing was originally scheduled for 2000 but was delayed; current plans call for the crossing to be replaced in the summer of 2003.

The Muckleshoot Indian Tribe currently funds and operates the White River Hatchery. The Tribe is not legally required to continue this production and funding by PSE is not part of the proposed action considered in this Opinion. As such, continued artificial production of WR spring chinook salmon may not occur (letter from B. Brown, NOAA Fisheries, to S. Moses, Tribe, June 7, 2002). Because NOAA Fisheries has 1) determined that the PS chinook salmon ESU includes the White River hatchery stock, 2) listed that hatchery stock as threatened, and 3) determined that this hatchery stock is essential to recovery of the PS chinook salmon ESU (64 FR 14308 and section 2.1.1.3 of this Opinion), discontinuation of the WR spring chinook salmon artificial production program would seriously undermine the environmental baseline and decrease the likelihood of PS chinook salmon recovery. While the prospective actions of the license address significant issues, it is not clear that the WR chinook salmon possess sufficient remaining resilience to survive and recover in the absence of augmentation from artificial production (Tynan 2002, pers. comm.). The prospective lack of artificial production until such time as the natural production population reestablishes itself under a prospectively improved environment represents another severe adverse risk to the chinook salmon ESU.

Regional Water Supply Project

Subsequent to the 1997 license order, PSE has joined with a multi-stakeholder group known as the Lake Tapps Task Force. This group seeks to develop a settlement agreement for the project license (the proposed action in this consultation) that maintains Lake Tapps, a significant aesthetic, recreational, and property value asset to the stakeholders. PSE has indicated that the 1997 license terms and conditions rendered the White River Hydroelectric Project economically non-viable. PSE has suggested it may retire the project, an action that would include draining Lake Tapps, removing the dikes and levies that maintain the lake, and decommissioning most project features.

The task force has developed a plan for a regional water supply project that is expected to create a positive revenue stream that would subsidize the uneconomic hydro project and allow the retention of Lake Tapps through the term of the license. PSE has applied to the WDOE for a preliminary permit for this project. In its Lake Tapps Reservior Water Right Preliminary Draft Feasibility Report, PSE (HDR 2002) indicates that the White River Hydroelectric Project "...will only be viable by the successful securing of a formal water right permit from Ecology, and development of this water supply by a regional water supply entity is critical to saving Lake Tapps Reservoir."

As a future private action, the water supply project is a cumulative effect. However, the proposed project would utilize distinct features of the hydropower license that are subject to FERC regulations. The project would utilize the diversion dam to divert White River water, the flowline to transport the water, and Lake Tapps as the storage reservoir for all water used in the water supply project. Therefore, the water supply project is not analyzed as a cumulative effect, as it will be subject to a separate Section 7 consultation as an amendment to the White River Hydroelectric Project license.

2.1.3 Conclusion

The final step in NOAA Fisheries' approach to determine jeopardy/adverse modification is to determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild. NOAA Fisheries has determined that, when the effects of the proposed action are added to the environmental baseline and cumulative effects occurring in the action area given the status of the stocks and condition of important habitat features, the action is likely to jeopardize the continued existence of the PS chinook salmon.

This conclusion is based on the likelihood that several project elements will appreciably reduce the functioning of already impaired habitat or will retard the long-term progress of impaired habitat toward a PFC (Table 2-6). No single project element would result in this conclusion; rather, it relies on the combination of several effects that reduce or impair properly functioning habitat conditions. As described in section 2.1.1.2, there is a strong causal link between habitat modification and the response of salmonid populations (NMFS 1999b). NOAA Fisheries has reviewed likely modifications to important habitat elements in order to infer the response of the White River population of the PS chinook salmon ESU to the proposed action. As described in section 2.1.1.3, the White River population is a crucial component of the PS chinook salmon ESU. Among other factors, the White River population represents one of the few Puget Sound chinook salmon populations with spring-run life history characteristics. Therefore, significant impacts to the WR chinook salmon population also result in significant impacts to the PS chinook salmon ESU, leading to the conclusion that these habitat impacts will jeopardize the PS chinook salmon ESU.

The key project elements that influenced NOAA Fisheries' conclusions are described in Table 2-6 and briefly summarized as follows:

1. Without a defined requirement in the license, there is no assurance that the diversion dam will be removed or reconstructed to NOAA Fisheries' standards for fish guidance or passage during the 50-year term of the license.

2. The license includes interim downramping rates consistent with the Washington State guidelines that will meet biological requirements; however, it also requires a plan with undefined future downramping rates that may be different and not protect juvenile chinook salmon (see article 404). The downramping guidelines do not specify the critical flow or amplitude restriction necessary to protect chinook salmon. The timing of flow diversions also affects chinook salmon, especially when flows are toggled between the bypass reach and diversion flume during spawning and incubation periods. Even with the downramping rate restrictions, stranding of juvenile fish will continue to occur in potholes and side channels drained by large downramping events.

3. The license provided for a plan that FERC may approve that permits disposing of sediment by returning it back into the bypass reach of the river (see article 402).

4. Unquantified juvenile chinook salmon losses in the flowline between its entrance and the juvenile fish screen facility (and possible mortality associated with the screen and bypass) may exceed the population's capacity for recovery.

5. The license fails to address frequent pH excursions above the desired level for chinook salmon in the bypass reach.

6. The license fails to provide sufficient flows for adult chinook salmon migration during May though July.

7. The license does not address occurrences of deficient dissolved oxygen in the tailrace discharge.

8. Project water diversions exacerbate high summer water temperatures in the bypass reach for the term of the license.

9. High summer water temperature tailrace discharges could continue to occur for the term of the license.

10. The license does not ensure that construction activities associated with the new powerhouse, tailrace barrier, or any other new structures will minimize adverse effects to listed salmon.

11. The license does not require adult access to the river reach between White River diversion dam and Mud Mountain Dam.

12. The license will result in the continued constraints of habitat-forming processes, including large wood and sediment input, in the bypass reach due to water diversion and the diversion dam structure.

2.1.4 Reasonable and Prudent Alternative

This section specifies RPA actions that NOAA Fisheries believes FERC may take to avoid the likelihood of jeopardy to the species (50 CFR 402.14(h)(3)). Section 7 regulations (50 CFR 402.02) limit RPA actions to: 1) alternatives NOAA Fisheries believes will avoid the likelihood of jeopardy, 2) alternatives that can be implemented in a manner consistent with the intended purpose of the action, 3) alternatives that can be implemented consistent with the scope of the action agency's legal authority and jurisdiction, and 4) alternatives that are economically and technologically feasible. If adopted by FERC, the RPAs do not undergo subsequent consultation to meet the requirements of section7(a)(2) of the ESA. The FERC acceptance in writing of the NOAA Fisheries RPA concludes the consultation process.

2.1.4.1 Description of the Reasonable and Prudent Alternative

NOAA Fisheries has identified the following alternative actions to the proposed action that will not jeopardize PS chinook salmon.

1. FERC shall modify article 401 prior to issuing the final license to include consultation with, and approval by, NOAA Fisheries of the plans to control erosion, contain sediment, and further minimize adverse impacts of construction activities (e.g., set construction timing relative to use of the affected area by salmon, control bank instability, plan to minimize likelihood of spills of chemical or petroleum products, reduce impacts to riparian vegetation, plan to salvage fish if necessary, etc.). The proposed construction plans must be submitted to NOAA Fisheries at least 90 days prior to project construction. Construction shall not begin until the construction plan has been approved by NOAA Fisheries and FERC. FERC or the Applicant must notify NOAA Fisheries if unanticipated events require deviation from the approved construction plan.

   This RPA element addresses Point 10 of the conclusions, the lack of specifications in the license that will ensure that construction activities minimize adverse effects to PS chinook salmon. By requiring NOAA Fisheries approval of a construction plan that addresses all potential adverse effects of construction activities, these impacts should be minimized sufficiently to meet biological requirements of PS chinook salmon. NOAA Fisheries will be evaluating the construction plans to ensure that, at a minimum, the construction plans provide the same level of protection for PS chinook salmon as that required of the Corps through NOAA Fisheries' biological opinion regarding 404 permit issuance.

2. FERC shall modify article 402 prior to issuing the final license to include consultation with, and approval by, NOAA Fisheries, of the Sediment Disposal Plan. The Licensee had indicated an interest in keeping open the option of sediment disposal back to the bypass reach of the river. Returning certain gravel sized sediments to the bypass reach could be beneficial to salmon, however, the preponderance of diverted sediments seem to consist of sand and fines. We find that action conditionally inconsistent with the survival and recovery of listed chinook salmon.

   This RPA element addresses Point 3 of conclusions. Sedimentation is best addressed in license article 402, which requires implementation of PSE's Sediment Disposal Plan, dated June 28, 1990. The authorization of any sediment disposal back to the bypass reach, without the river flow that originally delivered it to the project flowline, may adversely affect listed chinook salmon. Returning sediment to the bypass reach without sufficient water to disperse it, or carry it through the river system, could adversely affect incubating chinook salmon eggs or alevins, or otherwise interfere with the normal and effective rearing and migration of the listed salmon. FERC has on-site and off-site alternatives for sediment disposal that do not include discharging sediment from the flowline or its settling basins to the bypass reach of the river.

   PSE investigated fine sediments and substrates in the bypass reach (PSP&L, Hosey 1989), observing that streambed materials are relatively coarse in areas used by spawning salmon. Calculated indices generally did not fall within the range that would predict high mortality rates to incubating eggs and alevins, although the amount of fines in many of the samples could have adversely affected eggs and/or fry emergence. The clearest indication is that the White River is not sediment deficient, and actions that exacerbate fine sediment levels are not called for.

3. Retain article 403 and the Washington State guidelines as an interim downramping measure. The Washington downramping guidelines reduce, but do not avoid, fish stranding mortality. The downramping guidelines reduce fish stranding on gravel bars as much as seems practicable, but stranding mortality in pothole structures and perched side channels continues to occur. The way the project diversion is operated, and the frequency of downramps observed, suggests that adherence to the Washington ramping guidelines and the additional measures described herein will avoid jeopardy to the listed chinook salmon.

   FERC shall consult with NOAA Fisheries and modify article 404 prior to issuing the final license such that the final downramping plan is more protective in avoiding stranding than the interim plan in article 403. Note that downramping restrictions apply both to the bypass reach of the White River and the lower river downstream of the project tailrace.

The critical flow at which downramping restrictions are required in the project bypass reach is 2,000 cfs, an increase from the previous value of 1,000 cfs, based on the inference drawn from the April 9, 2003 fish kill that resulted from a downramping event begun at 1,600 cfs. Additionally, daily amplitude changes in flow will be limited to 50%, or less. (For example, if the beginning bypass reach flow is 1,600 cfs, the flow reduction - amplitude - in a 24-hour period will be limited to 800 cfs, with 800 cfs or more remaining in the bypass reach. The second 24-hour period may reduce the bypass reach flow by up to another 400 cfs.) This is based on the downramp-induced fish kill of April 2003, where the downramp event was an eight-fold decrease in flow (1,600 to 200 cfs) in one continuous downramping event. Stranding studies on the Skagit River established that amplitude is a significant factor contributing to stranding mortality (Beck Associates, R.W. 1989).

Part of the study contemplated by article 404 has been completed. Potential stranding locations in the lower White and Puyallup rivers are few. The critical flow threshold for stranding in the lower Puyallup River is 2,500 cfs. We believe the performance standard required in the above paragraph can be attained by correlating stage changes at the lower Puyallup River gage, when flows are 2,500 cfs or less, to stage changes in the tailrace gage. The corresponding incremental changes of the tailrace gage can be expected to provide Washington guideline protection at potential stranding locations in the lower Puyallup River. The guidelines measure downramping in units per hour, but it should be noted that the intention is to exclude instantaneous downramps that are subsequently averaged over the hour. The intention is to incrementally decrease streamflow gradually over the smallest recorded units of time, typically 15 minutes at USGS stream gages.

FERC must require PSE or a third party to prepare an annual report to NOAA Fisheries that documents downramping compliance. FERC must require detailing any violations of ramping rates during the previous year, including: date, time, cause, flow rate, and duration of event, and a section of measures undertaken to avoid future recurrences. In addition to the annual report, FERC must require PSE to report any downramping violation that exceeds authorized rates by more than 10% to NOAA Fisheries within 10 days of its occurrence. These reports must also include details of the event, probable cause, and measures PSE proposes to implement to avoid or reduce recurrences.

This RPA element addresses Point 2 of the Conclusions.

4. FERC shall modify article 405 bypass reach minimum instream flows so that February, March, and April are 250 cfs unless and until PSE demonstrates and NOAA Fisheries concurs that water quality improvements have resulted in pH reductions to 8.5 or less such that flows may be adjusted downward toward 180 cfs. Modify the license article to require PSE to fund a third party acceptable to NOAA Fisheries, to monitor water quality. The water quality monitoring program must be developed within 6 months and approved by NOAA Fisheries.

Increase the minimum instream flows for May, June, and July from 180 to 265 cfs to ensure adequate adult passage. The article should also be modified to require PSE or a third party to prepare an annual report to NOAA Fisheries detailing any violations of minimum flow rates during the previous year, including: date, time, and duration of event, and flow rate.

This RPA element addresses Points 5 and 6 of the conclusions.

5. FERC shall modify article 406 prior to issuing the final license to go beyond the plan to include the actual installation, operation, and monitoring of, and reporting from, the proposed stream gages within one year of the date of license issuance. Gages should be approved by USGS, with discharge, stage, and real-time data publicly available via the internet.

   Since the date of the preliminary draft opinion, it is now known that the most accurate stream gage for the White River bypass reach (USGS 12100000), located just downstream of the diversion dam at the Tacoma Water pipeline crossing, will more likely than not be lost from use during the summer of 2003 as Tacoma replaces its water pipeline crossing. Consequently, there is a need for an interim gage to be installed, monitored, and maintained by PSE until such time as new permanent recording gages are installed.

   FERC shall not authorize PSE to divert any water without first, in consultation with NOAA Fisheries, installing a temporary recording gage to ensure that minimum instream flows are being discharged to the project bypass reach. FERC shall also require PSE to maintain and monitor the rating of this temporary gage by a third party as frequently as necessary to ensure the required instream flows are being delivered to the bypass reach.

   This RPA element partially addresses Points 2, 5, 6, 7, 8, and 9 of the conclusions.

6. FERC shall retain article 408 to include the tailrace barrier. This is not a change from the proposed action because this was not identified as a reason for the jeopardy conclusion. The tailrace barrier would facilitate fish migration upstream through the bypass reach, rather than into the project tailrace where delay and injury may occur.

7. FERC shall modify article 409 prior to issuing the final license to specify annual monitoring of the flowline, juvenile screen, and bypass and periodic monitoring of adult migration delay and success in the vicinity of the tailrace barrier in consultation with and approval by NOAA Fisheries. If monitoring determines the juvenile survival rate to be less than 98% or the median adult delay to be more than four days, then FERC will require PSE to develop a plan, which must be approved by NOAA Fisheries, to correct the problems causing the high mortality rates or delay. FERC must require PSE or a third

party to prepare an annual report to NOAA Fisheries detailing the results of the monitoring required by this RPA element.

This RPA element addresses Point 4 of the conclusions.

8. FERC shall retain article 412. This is not a change from the proposed action because it was not identified as a reason for the jeopardy conclusion.

9. FERC shall amend the license order to include an article specifying either the removal or reconstruction of the project diversion dam near RM 24 within 24 months. If removed, the action must be coordinated with the Corps such that the capacity for effective use of the Corps' fish ladder and trap and haul facilities is not decreased. If reconstructed, the action must be in consultation with NOAA Fisheries to ensure that minimum instream flows are prioritized to the ladder and river bypass reach ahead of the diversion flowline, and to ensure that the dam effectively leads migrating salmon to the respective fish ladders on either river bank. The facility must also be designed for effective passage of forebay sediment and large woody debris. If the dam is to be reconstructed, the Licensee must provide plans for FERC and NOAA Fisheries' review and approval within 24 months of license issuance and construction within 42 months.

   The Corps is currently evaluating alternatives to ensure a long-term viable method for upstream fish migration. One of the alternatives under consideration is new construction at the existing diversion dam site. A Corps project at this site could obviate the need for, and render redundant, reconstruction by PSE. If the Corps continues to develop this alternative, NOAA Fisheries will coordinate with FERC, PSE, and the Corps to ensure that the RPA objective for effective fish passage is attained. Should the Corps not develop a project at this site, the burden remains with PSE.

   The Muckleshoot Indian Tribe operates the White River Hatchery, located adjacent to the diversion dam. The Tribe shall also be consulted in regards to the diversion dam's design features because the hatchery takes some of its water supply from the river at this point and because the hatchery fish ladder is affected by the dam.

   This RPA element addresses Points 1, 11, and 12 of the conclusions.

   The measures described in the proposed articles 302 and 401 would reduce, but not preclude, erosion and sedimentation of the river channel. The probable construction season overlaps with the chinook salmon spawning season, and significant numbers of chinook salmon spawn in the area immediately downstream of the diversion dam. Consequently, there is a likelihood of direct take of incubating chinook salmon eggs through sediment deposition in that river reach when incubating eggs are present.

Estimating the loss from this action is impossible. Most of the chinook salmon population spawns upstream of MMD, and these fish are not likely to experience adverse affects from sediment release, unless its timing, duration, or lack of a suitable dam prevents the chinook salmon from entering the fish ladder and trap. Of those chinook salmon that spawn downstream of the diversion dam, it is unknown what proportion will be affected by sediment deposition for two reasons. First, glacial turbidity of the water precludes accurate surveys of the number of spawning chinook salmon, but spawning chinook salmon, their spent carcasses, incubating eggs, and emergent fry, have all been observed. Second, it is unknown how far downstream the lethal effects of the sediment deposition might extend, and it is impossible to separate mortalities from this effect from others that are common to incubating salmon eggs and alevins. Spawning survey information from the Muckleshoot and Puyallup tribes indicate that more chinook salmon spawn in the upper half of the bypass reach than the lower, which is consistent with NOAA Fisheries' own habitat evaluation that the upper portion is better suited to chinook salmon reproduction than the lower.

Take of listed chinook salmon would occur as an acute effect whose duration should be limited to the construction and spawning/incubation season in which it occurs. No long-term effects are predicted from this construction activity, but long-term adverse effects that jeopardize chinook salmon could result if the dam is not renovated or reconstructed. Long-term effects of a new diversion dam are expected to be beneficial to chinook salmon. A new dam will provide more precise flow control and not be subject to the loss of flashboards and hydraulic control as happens under existing conditions. As a new structure, chinook salmon are also expected to benefit by the absence of protruding rebar, broken or missing apron boards, or other structural parts that injure fish or cause mortality.

10. FERC shall amend the license order to include an article specifying a plan and an action to comply with the dissolved oxygen standard of 8 mg/l in the tailrace discharge. FERC must also require PSE or a third party to prepare an annual report to NOAA Fisheries detailing water quality observations from the previous year, including DO from the tailrace. The plan should include consultation with the agencies and parties to the 1998 Agreement on the Allocation of the Puyallup River TMDL Reserve Capacity of Biochemical Oxygen Demand (BOD%) and Ammonia.

    This RPA element addresses Point 7 of the Conclusions.

11. FERC shall amend the license order to include an article adopting temperature standards for the White River project bypass reach. The 7DADM (Daily Average of Daily Maximums) standard from October through May is 13.3°C. The 7DADM standard from June through September is 16°C. The control points for this summer season standard is both the diversion dam and RM 4.0. This RPA element includes a default action and two potential alternative actions. We anticipate that the License Applicant, in consultation

with NOAA Fisheries, will verify the feasibility of the alternative during the summer of 2003. The default action is the RPA action unless and until the alternative is deemed viable, selected, and developed by the Applicant with NOAA Fisheries' approval. The respective actions are described as follows:

The default action requires a straightforward change in streamflow response to water temperature that exceeds the standard. When the June through September standard is exceeded at either the diversion dam or at RM 4.0, the Licensee shall increase the minimum instream flow in the bypass reach to 500 cfs. As the 7DADM declines below the standard, instream flows may be reduced to the designated flow for that month.

The preliminary draft opinion differed in designating the diversion dam as the temperature control point. We are supplementing the June through September control point to include RM 4.0 because water normally warms in the downstream direction. The temperature standard could be reached first at either location. The intent is to provide water quality protection to listed chinook salmon in the bypass reach; therefore, it is reasonable and prudent to monitor temperature at control points at the upstream point of water diversion and near the downstream end of the bypass reach. The preliminary draft also described cessation of all water diversion as the protective measure. That would be the most effective response with respect to elevated water temperature. The greater the flow volume in the bypass reach, the less heat is accumulated. Unfortunately, it does not address the interrelated issue associated with downramping of large fluctuations in instream flow in response to rising and falling temperatures. Elevated temperatures and stranding caused by downramping are both deleterious to fish. NOAA Fisheries chooses to reduce the effects of both these factors. In response to elevated temperatures, above 16°C 7DADM at either the diversion dam or RM 4.0, the instream flow will increase to 500 cfs, cooling the river by 1°C or more, and functionally reducing fish density-related stress in the bypass reach. Increasing the instream flow to 500 cfs very significantly limits potential fish stranding losses due to downramping that coincides with changing water temperatures.

The interrelationship with flow fluctuations and fish stranding is an important one. Redirecting all the available streamflow to the bypass reach could increase the bypass reach flow from 265 or 350 cfs to well over 1,000 cfs, if not more, avoiding 2 to 4°C of temperature increase. River flow volumes of 500 cfs, and perhaps somewhat greater, water the main river channel and primary side channels. The main channel and primary side channels are suitable as juvenile fish rearing habitat. At flows over 1,000 cfs, more secondary side channels are watered, and the main channel becomes less suitable as juvenile rearing habitat. Juvenile fish are expected to prefer the primary and secondary side channels at the higher flows. Subsequent downramps in response to cooler weather and water temperatures, even with our more conservative measures in RPA element 3, will, in the course of one or two days, completely drain the secondary side channels. The slow downramping rate of change in flow will reduce and avoid most bar stranding of juvenile fish, but numerous potholes occur in the side channels, and significant losses of are expected if this action occurs frequently. NOAA Fisheries is conditioning the temperature response measure to an increase in bypass reach flow to 500 cfs to reduce direct loss of listed salmon that would be associated with greater changes in streamflow. NOAA Fisheries believes this trade-off finds the most effective balance between the deleterious effects of elevated water temperature and stranding induced by flow fluctuations.

The first alternative action to the above response is the development of juvenile thermal refugia in the bypass reach. Wall-based channels have been observed along the margins of the flood plain within this reach. Presently, we do not know the number of such channels nor if 1) water sufficient for refugia is present; 2) the water is cooler than river water; and 3) sites are developed, if they can be protected from floods. The Licensee may select this measure as an alternative to increasing instream flow in the bypass reach for juvenile salmon in consultation with, and approval by, NOAA Fisheries.

Should this alternative prove feasible as thermal relief for juvenile chinook salmon, action is still necessary to protect adult chinook salmon. The Licensee shall respond to temperatures above 16°C at the diversion dam or RM 4 by providing pulse flows of 500 cfs for 48 hours at 10 day intervals to stimulate adult chinook salmon migration through the project bypass reach. Downramping restrictions apply to the subsequent flow reductions.

This alternative involves the development of suitable juvenile salmon rearing habitat off the main river channel that contains wall-based water that is cooler than the river. If the potential exists and several of these are developed, well distributed through the bypass reach, we believe it would offer an effective thermal refuge from the elevated water temperature conditions in the main bypass reach river channel.

The second alternative action is also at the Applicant's discretion. The Applicant may, in consultation with and approval by NOAA Fisheries, develop and operate a predictive model for bypass reach water temperature based on monitoring relationships between air and water temperatures in the immediate area. This would supplant reacting to monitored changes in water temperature at the control point.

The tailrace upper limit temperature standard is the temperature of the bypass reach at the point of confluence with the tailrace at RM 3.6. That is, the Licensee will not discharge water that is warmer than the bypass reach during the months of June through September. This condition avoids any project-induced warming of the lower White and Puyallup rivers during the summer season of concern. FERC must also require PSE or a third party to prepare an annual report for submittal to NOAA Fisheries detailing water quality monitoring observations from the previous year, including temperature from the bypass reach, and tailrace, and associated downstream flows.

This RPA element addresses Points 8 and 9 of the Conclusions.

12. [Placeholder] FERC shall amend the license order to include an article specifying the provision of artificial production of WR spring chinook salmon to include -------- yearling juveniles and --------- subyearlings for the term of the license to mitigate the regular chronic fish kills associated with stream flow manipulation by the project and to assist the recovery of the species in the near term. -------- shall provide NOAA Fisheries a plan for compliance with this RPA element within 6 months of the effective date of the license and begin implementation upon approval by NOAA Fisheries.

    There are certain adverse effects of the project that will continue, even with the above RPA elements. This is because some of the RPA elements can only partially alleviate certain project effects and because some of the RPA elements do not take effect for months or years, so current effects continue for some period of time. NOAA Fisheries therefore concludes that an additional measure is required to avoid jeopardizing PS chinook salmon. Funding artificial propagation of WR spring chinook salmon is an important and effective action as discussed in sections 2.1.1.3 and 2.1.2.2.

13. FERC shall amend the license order to include an article specifying the timing of planned project maintenance outages. Planned maintenance outages should occur in August, unless otherwise coordinated with, and approved by, NOAA Fisheries. This RPA element addresses Point 2 of the Conclusions.

2.1.4.2 Conclusion for the Reasonable and Prudent Alternative

NOAA Fisheries has determined that, when the effects of the RPA are added to the environmental baseline and cumulative effects occurring in the action area, given the status of the stocks and condition of important habitat features, the action is not likely to jeopardize the continued existence of the PS chinook salmon. This conclusion is based on the preceding discussion, which evaluates each of the 13 reasons for determining that FERC's proposed action is likely to jeopardize PS chinook salmon (section 2.1.3), and identifies an RPA element that either partially or completely alleviates the adverse project effects that lead to the jeopardy conclusion.

2.1.5 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; 2) new information reveals effects of the action may affect listed species in a way not previously considered; 3) the action is modified in a way that causes an effect on listed species that was not previously considered; or 4) a new species is listed or critical habitat is designated that may be affected by the action. As described in section 2.1.4, any use of

FERC-authorized project features to remove water for consumptive purposes is not authorized by this Opinion and will require reinitiation of consultation. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

2.2 Incidental Take Statement

Sections 4(d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined in 50 CFR 222.102 as "an act that may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering." Harass is defined as actions that create the likelihood of injuring listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is take of listed species that results from, but is not the purpose of, the Federal agency or the Applicant carrying out an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

The Incidental Take Statement does not extend to actions undertaken under license terms and conditions that NOAA Fisheries has not consulted on or plans that NOAA Fisheries has not approved.

2.2.1 Amount or Extent of Take

The proposed action is reasonably certain to result in incidental take of the listed species. NOAA Fisheries is reasonably certain the incidental take described here will occur because 1) recent and historical surveys indicate the listed species are known to occur in the action area and 2) the proposed action would adversely affect important habitat features that would in turn reduce the survival of the listed species for feeding, breeding, or sheltering. NOAA Fisheries anticipates that a small, but undetermined, number of PS chinook salmon may be taken as a result of full implementation of the proposed action, including the RPAs described in section 2.1.4 above, and associated levels of protection over the term of the license. The incidental take is expected to be in the form of adult migration delay, harm, harassment, kill, or injury at the diversion dam; juvenile entrainment and loss, injury, or mortality in the flowline and bypass screen facility; and other activities covered by the project license.

Despite the use of best scientific and commercial data available, NOAA Fisheries cannot quantify a specific amount of incidental take or individual fish or incubating eggs for this action. Instead, the extent of take is anticipated to be that which is associated with incorporation of the criteria included in the RPA (e.g., minimum flows and dissolved oxygen levels; temperature standards and reduction of pH excursions associated with authorized project operations).

2.2.2 Effect of Take

As analyzed in this Opinion and described in section 2.1.3, and with implementation of the RPA of section 2.1.4, NOAA Fisheries has determined that this extent of anticipated take is not likely to result in jeopardy to the species survival and recovery.

2.2.3 Reasonable and Prudent Measures and Terms and Conditions

Reasonable and Prudent Measures and implementing Terms and Conditions are non-discretionary measures to minimize take, that are not already part of the description of the proposed action. They must be implemented as binding conditions for the exemption in Section 7(a)(2) to apply. FERC has the continuing duty to regulate the activities covered in this incidental take statement. If FERC fails to require the Applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. NOAA Fisheries believes that activities carried out in a manner consistent with these reasonable and prudent measures, except those otherwise identified, will not necessitate further site-specific consultation. Activities which do not comply with all relevant reasonable and prudent measures will require further consultation.

NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of listed fish resulting from implementation of the action.

All measures described above in section 2.1.4, RPA elements numbered 1 through 13, are hereby incorporated by reference as terms and conditions imposed on the license for FERC Project 2494 within this Incidental Take Statement.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));
- NOAA Fisheries must provide conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A));
- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), and site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: chinook (*Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*)(PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based, in part, on this information.

3.3 Proposed Actions

The proposed action and action area are detailed above in sections 1.3 and 1.4 of this Opinion. The action area includes habitats that have been designated as EFH for various life history stages of chinook, coho, and chum salmon.

3.4 Effects of Proposed Action

As described in detail in section 4 of this Opinion, the proposed action may result in short- and long-term adverse effects to a variety of habitat parameters. These adverse effects are:

1. As described in section 4, the presence of the project diversion dam blocks passage to spawning and rearing habitat previously occupied by chinook salmon.

2. As described in section 4, flow regulation by the project results in habitat perterbations and ramping rates that can strand juvenile fish.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action would adversely affect designated EFH for chinook, coho, and pink salmon.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in the BA will be implemented by FERC, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. However, the RPA described in section 2.1.4.1 and the terms and conditions outlined in section 2.2.3 are generally applicable to designated EFH for chinook, coho, and pink salmon, and address these adverse effects. Consequently, NOAA Fisheries recommends that they be adopted as EFH conservation measures.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The FERC must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

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APPENDIX A

MEMORANDUM

Date: July 7, 2003

To: White River Hydro Division File

From: Steve Fransen

Subject: NOAA Fisheries' Response to Comments on Preliminary Draft BO.

Comments to our Preliminary Draft Biological Opinion (PDBO) and our responses follow:

The Environmental Protection Agency (EPA) advises that the White River is not meeting water quality standards for numerous pollutants including temperature and pH. NOAA Fisheries has included a contingent condition in RPA element 4 to reduce pH excursions and developed an RPA element to respond to elevated water temperature. We also conclude that FERC should require the Licensee's participation in the consultation with the agencies and parties to the 1998 Agreement on the Allocation of the Puyallup River TMDL Reserve Capacity of Biochemical Oxygen Demand (BOD%) and Ammonia.

The U.S. Army Corps of Engineers (Corps) provided 16 specific comments. Comment 1 indicates an error in our source document reflecting the length of Mud Mountain pool inundation when it is not storing water. The statement has been deleted. Comment 2 infers that we conclude that the action of Mud Mountain Dam (MMD) trapping large volumes of wood and sediment affects downstream channel dynamics. We do not conclude that this occurs annually and believe the general conclusion is correct. Therefore, no revision was made. Comment 3 indicates that MMD removes wood, not seasonally, as indicated in the PDBO, but may go as long as 2 or 3 years without removal. Our statement has been revised. Comment 4 requests a citation regarding the deposition of sediment in the river reach nearest MMD. There is no citation; our statement has been revised to reflect the source of information.

The Corps' Comment 5 refers to our characterizing MMD fish passage as partial mitigation in Table 2-2. The Corps' understanding is that the trap-and-haul operation fully mitigates for fish passage. A table must be succinct to be effective, so the provision of complete information is not possible. No artificially constructed fish passage system is 100% successful in our collective observation. The anecdotal evidence regarding the Buckley fish trap provides enough information to infer that the trap-and-haul operation does not collect 100% of the White River population of upstream migrating fish. Fish have been observed becoming stranded on the apron of the diversion dam, fish show up injured in the trap, and there is an unexpectedly high concentration of spawners immediately downstream of the trap and diversion dam. We believe this is reason enough to conclude that the passage system is less than 100% efficient.

Comment 6 references the disruption of wood transport through MMD and the river. Our reference is to large wood that we understand is blocked by MMD. It is not clear to us that MMD passes large material, due to the presence of the project trash rack. If MMD routinely passes large wood, we have not seen that information.

Comment 7 refers to low pool frequency due to reduced flows and a lack of pool forming processes. While high flows occasionally occur in the White River, they do so at a reduced frequency due to MMD operations. That, and the changed timing of sediment transport, are among the factors affecting pool formation and maintenance.

Comment 8: refer to previous response. Comment 9 refers to the diversion dam, and our description is revised. Comment 10 refers to the effectiveness of fish passage at the trap and diversion dam. We disagree and believe that high density spawning immediately downstream of a flow control structure and fishway is a fairly strong indicator of less than completely effective fish passage.

Comment 11 refers to mortality studies at the diversion fish screen. Because of the facility design and layout, it is not clear that the screen and bypass are entirely effective. Comment 12 refers to uncertain future ramping rates decided by FERC. The reason FERC might decide on less protective ramping rates is that FERC balances power and non-power interests in its licensing decisions. Inclusion of protective ramping rates in the Opinion is the only certainty that future license conditions will be equally protective of juvenile chinook salmon. Comment 13 references adult access to the river reach between the diversion dam and MMD. We agree that adult spawner access to this river reach should be a decision of the fishery managers. Our statement merely captures the fact that such access is not a condition of FERC's proposed license.

Comment 14 refers to a sediment disposal plan. Diverting river water without the sediment load associated with it means the bypass reach channel will be heavily loaded with sediment and without the water flow necessary to transport the sediment to the natural deposition zones. This adversely affects spawning and rearing habitat. NOAA Fisheries wants Puget Sound Energy (PSE) to take the sediment associated contained in the diverted flow and dispose of it separately, rather than imposing the adverse affect of high sediment and low flow on chinook salmon. Comment 15 further refers to disposing of sediment in the bypass reach. The subject is too broad to address all details in the Opinion, and should, and we expect will, be addressed in the specific context of the sediment disposal plan. NOAA Fisheries also will work with the Corps on this topic in the context of designs for a new diversion and fish barrier dam.

Comment 16 references the timeframe for removing or renovating the diversion dam. We note that the Corps is conducting a feasibility study for its long-term fish passage obligations. The

FERC licensing process and the Corps' study and project development process are on different timelines. NOAA Fisheries expects that the eventual course of action, whether a new diversion dam by PSE, or a dam by the Corps, will involve extensive coordination among the affected parties. NOAA Fisheries cannot predict when, or if, the Corps will develop a barrier dam for its White River fishway. Therefore, in the interest of the affected fish resources, it is prudent to retain a license requirement that the Licensee provide an effective barrier to assure effective fishway operation. NOAA Fisheries will modify the timeframe for the Licensee's responsibility based on progress toward an alternative method of serving the interest in effective fish passage.

The Washington Department of Fish and Wildlife (WDFW) also provided comments. Regarding ramping rates, RPA element 3 has been revised to better reflect the period of time for averaging. Regarding minimum flows and pH, we are obligated to form an opinion based on best available scientific and commercial data available, not that which may become available pending studies as yet unplanned. RPA element 7 describes monitoring for the effectiveness of fish migration and screen effectiveness. WDFW agrees with our conclusions at RPA elements 8 and 9. WDFW suggests increased flow to mitigate temperature effects, or alternatively, develop new trap and haul facilities located on the lower White River so that upstream migrating fish would be routed around the adverse conditions. We disagree with this alternative because downstream migrants would continue to experience bypass reach conditions, and we are directed to improve habitat toward "properly functioning condition." WDFW agrees with RPA element 12. WDFW suggests adding an RPA to address the timing of planned project outages. That was intended for the previous draft, and the oversight has been added to this draft. WDFW references the Lake Tapps Task Force's recommendations regarding a recovery plan and harvest which we address in other sections of this Opinion.

The U.S. Fish and Wildlife Service agrees with NOAA Fisheries' approach to chinook salmon protection. The protective measures for chinook salmon may be less protective of bull trout with regard to water temperature.

The Puyallup Tribe provided comments as well. The Tribe supports a water temperature standard of 13.3°C at the diversion dam. We have substantially revised the discussion of temperature in the analysis of effects and in RPA 11. The Tribe further commented on the report on water temperature by R2 consultants. We have expanded our discussion of this as well in this draft opinion.

The Muckleshoot Indian Tribe also commented on the PBDO in 6 attachments. These included comments on our preliminary draft, the R2 report on water temperature, a memo from Dr. Joel Massmann which reviews PSE's temperature model, the EPA draft guidance document, the EPA Issue Paper 5 regarding temperature effects on salmonids, and a technical synthesis paper submitted to the Policy Workgroup of the EPA Region 10 Water Temperature Criteria Guidance Project.

The Muckleshoot Indian Tribe indicates that RPA element 11 temperature criteria are not sufficiently protective of all life stages of spring chinook salmon. We agree. Given that background temperatures of the White River regularly exceed preferred levels for chinook salmon, NOAA Fisheries cannot realistically set such standards with any expectation of attainment. Further, this Opinion's RPA is intended to establish habitat conditions that support the survival and recovery of listed chinook salmon. This is a different standard than preferred and optimal temperatures. MIT reminds us that this Opinion establishes a temperature standard that is not consistent with the opinion NOAA Fisheries issued for the MIT Amphitheater project. The respective opinions adopt different standards for two reasons. First, background temperatures in the White River regularly exceed preferred and optimal temperatures for chinook salmon, and, second, the temperature standard in this Opinion was relaxed as a trade-off between the adverse effects of elevated water temperatures and the adverse effects of flow fluctuations caused by project operations. We could not craft an RPA that effectively avoids both effects. The RPA does, however, reduce both effects. The previous statement responds to MIT's comments regarding our guidance document and water temperature modeling and the R2 report. RPA element 11 requires temperature monitoring and is an action plan.

RPA element 12 is revised. RPA element 3 is revised to improve clarity, as suggested. RPA element 5 is also revised. RPA element 9 includes consideration of the White River Hatchery in designing a new diversion dam. RPA element 10 adds dissolved oxygen and TMDL coordination. Additional comments regard reinitiation of consultation. Consultation may be reinitiated if conditions changes substantially from those anticipated in this Opinion.

PSE/LTTF submitted 60 pages of comments with 12 attachments. The comments paralleled our 12 elements of the RPA, supplemented with two more, a recovery plan and harvest. Each comment includes a statement of the issue, scientific basis, legal basis, economics, policy, and a recommendation. We respond to the substantive comments in various sections of this draft opinion, generally in the effects analysis or the specific RPA element, rather than in this section. Briefly, we have slightly revised the downramping RPA. RPA element 4 refers to pH. PSE/LTTF disagree with NOAA Fisheries' resolution of that issue, although we have attempted to clarify our conclusion.

PSE/LTTF is surprised that NOAA Fisheries assumes the diversion dam would not be renovated nor replaced under the new license. We disagree about the ambiguity in this regard. FERC interprets its licenses. PSE/LTTF maintain that the plain language of the license order makes this RPA element redundant. The history of FERC licenses includes numerous differences among FERC, Licensees, and agencies in the interpretation of licenses. A license article specifying a new diversion dam is not ambiguous; therefore, the Opinion requires its specification. PSE/LTTF further suggest that the Corps' fishway, in association with the diversion dam, is an interrelated and interdependent facility and action. It is, and the fishway function will be addressed in a separate Section 7 consultation with the Corps on the operation and maintenance of MMD. PSE/LTTF further maintain that the RPA element is not necessary because it is already included as part of the proposed action. RPA elements repeat the proposed actions that avoid jeopardy, modify proposed actions that contribute to jeopardy, and add new actions necessary to the proposed actions to avoid jeopardy.

PSE/LTTF comment extensively on water temperature, covering the separate recommendations of several agency biologists, the R2 consultant's report, and then makes a temperature recommendation based on economics, concluding that temperature standards based on the species needs are not economic for the project. We have substantially revised RPA element 11 and expanded the discussion of the temperature effects analysis. We also indicate that our analysis of instream flows finds that the White River water supply is sufficient to meet the needs of listed chinook salmon and maintain Lake Tapps and support the informally proposed regional water supply project. As suggested, we further discuss recovery and harvest, although we do not reach the same conclusions as PSE/LTTF.

PSE/LTTF commented that NOAA Fisheries has not considered harvest of White River chinook salmon sufficiently, in contrast to the project and other environmental effects, with respect to the decline of the stock and its subsequent listing under the ESA. A discussion of harvest and harvest issues is now included in the section regarding status of the species.

PSE/LTTF pointed out that the multi-party 1996 recovery plan for White River spring chinook salmon identifies an interim escapement goal of 1,000 unmarked spawners is met 3 out 4 consecutive years, with normal levels of incidental sport, commercial, and tribal harvest. (Note: unmarked spawners were presumed to result from natural production, with all hatchery chinook salmon being marked. Some confusion is apparent with respect to recent returns that included unmarked adult chinook salmon of hatchery origin.) A recovery plan under ESA has yet to be prepared, however. PSE/LTTF noted that this Opinion does not address the significance of the goal in the 1996 recovery plan or its apparent recent achievement. The goal will be considered, and may satisfy the needs of recovery; however, it is premature and speculative to qualify its appropriateness in the context of this consultation. Again, its apparent achievement is due to an apparent misunderstanding that the unmarked chinook salmon in recent years were a mix of wild and unmarked hatchery chinook salmon, when the intent of the recovery planners was for 1,000 chinook salmon from natural production. Given the stated intentions of the recovery planners, the interim goal remains yet to be achieved.

PSE/LTTF commented that the Opinion does not document our statement that past actions of the project were significant factors for decline of White River chinook salmon. Support for the statement is included in the section that describes Current Conditions, Including Factors For Decline.

PSE/LTTF comments included an economic analysis and a summary of the discussion of water temperature at the technical meetings. Meeting participants from DOE, WDFW, and NOAA Fisheries recommended 16°C, with USFWS recommending 15°C because of bull trout occurrence in the same watershed. PSE's assessment is that 16°C is not economically feasible for the project. The Corps recommended 18°C, which was alternatively suggested by DOE. PSE determined that 18°C is not economically feasible for the project. According to PSE's comment response to the PDBO, the cost of generating electricity at White River is $41 per megawatt hour with no FERC license and no license mitigation requirements. The proposed FERC license evaluated in this Opinion would increase the cost of generating electricity at White River to $61 per megawatt hour. Presumably, the additional conditions imposed by this Biological Opinion on the proposed FERC license would further increase the cost of generating electricity at White River, although by what amount, we do not have the means to calculate. The wholesale price of energy in the Northwest region has been around $30 per megawatt hour, occasionally more, and often less. Based on the economic information that PSE has provided, it appears to us that the White River Hydroelectric Project is not an economical source of energy even with no FERC license, and no license-associated project mitigation expenses. Consequently, there are no modifications that NOAA Fisheries could make that leave the project economically feasible, even with no license conditions to make the project consistent with the survival and recovery of listed chinook salmon.

The alternative temperature standards recommended by PSE/LTTF are consistent with an improved economic outlook for the White River project, but are inconsistent with the biological interests of survival and recovery of White River chinook salmon and the Puget Sound ESU salmon.